VOL. XXXI NEW YORK—THURSDAY, DECEMBER 10, 1914—CHICAGO No. 24

The AUTOMOBILE

War Stops Olympia, But Not Car Development

Automobile Industry in England Shows Marked Trends in Spite of Interruption in Buying—Light Fours the Feature—Sixes Hold Their Own

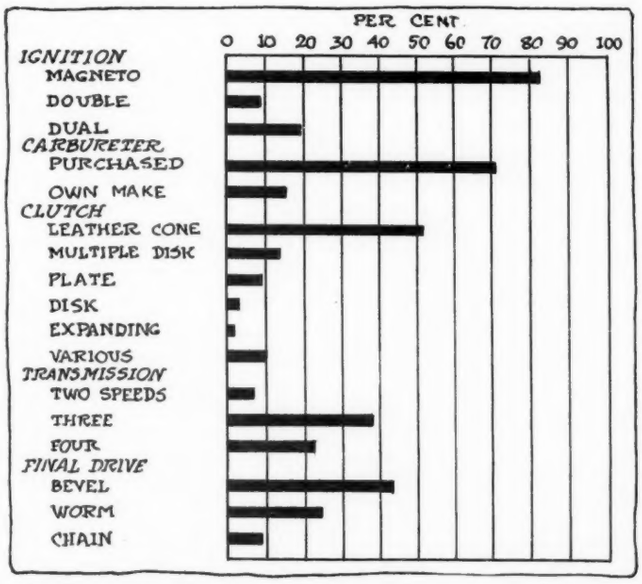
By J. Edward Schipper

THERE is no Olympia show this year in London. The Gods of War have so ordered. Yet this dictum cannot stop entirely the wheels of progress and thought. We still turn toward Olympia and, though war has laid its staying hand upon the exposition, nevertheless, the 1915 announcements of the English factories show that cardinal trends would have been brought out by the show. When war was declared, the plans of the designers were already well formulated and the 1915 test chassis were on the road. Consequently there has been little falling off in the number of announcements for the new season, and as far as the engineering development of the industry is concerned, there has been no interruption in progress.

More Small Cars

Most important is the increase of the number of small cars listed in the neighborhood of $875. The Ford in Great Britain sells for $610, which will give a comparative idea of the prices of the small British products. A number of the small cars are developments of the cyclecar movement of the past 2 years. These cars are now miniature automobiles built along the same lines as the larger cars, with a standard tread but with shorter wheelbase and generally smaller lines. The upholstery and equipment are as luxurious as on the larger cars, extreme lightness in the power plant and structural work providing maximum economy.

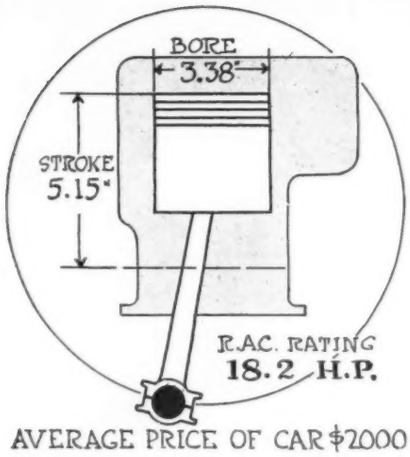
These small cars have a piston displacement averaging close to 65 cubic inches. The bore ranges from 60 to 70 millimeters, or 2.36 to 2.75 inches, with a stroke approximating 3 inches. Makers, who have had cars in this field before, are endeavoring to secure more power for a given piston displacement. The result has been an increase in the valve sizes and in the compression. Throughout the entire light car practice the manufacturer is endeavoring to get as much power as he can from an engine that will give him the maximum fuel economy. The result is that the little machine is apt to be somewhat overloaded with the fully equipped body.



Predominating features of British cars may be mentionad as magneto ignition, cone clutches and bevel drive. The percentage of three-speed gearset is not greatly in excess of four-speed types

Sell Cars Equipped

Still another tendency is that of selling the car with full equipment. In this respect the British manufacturers are following the American lead, as well as the example set by Renault a year ago in France. We now find it customary for British cars



The average British car would sell for $2,000 and would have an R.A.C. rating of 18.2 horsepower. Dimensions would be 3.38 by 5.15

to be advertised as equipped with electric lighting and starting. Although it is not true that cars selling as low as $750 are so equipped as yet, the rapid trend in that direction indicates that if normal progress is not interfered with in the next year or 2, British cars will be fitted with the same electric equipment as the American at approximately the same price. Last year less than 15 per cent. of the exhibitors at Olympia had electric starters, but were a show held this year the percentage would approximate 40.

Thermo-syphon cooling is used on 90 per cent. of the cars having a piston displacement of 200 cubic inches or less. Above this displacement the pump system of cooling is used on more than 50 per cent. of the motors. In British practice, as in American, there has been a growing tendency towards increasing the volume of water surrounding the cylinders, and large jacket spaces are the rule for even the smallest motor.

Electric lighting is found on practically every car marketed as low as $975. In some instances acetylene headlights are supplied with electric lamps for the side and tail; in the latter case a storage battery is used.

In general the tendencies of design are but continuations of those noted last season. The body maker in his efforts to meet the fashions of the day in coach work has made changes which stand out more prominently than any of those of a mechanical nature. The efforts to meet American competition in the low-priced car have been continued, and as a result the fully equipped, small four-cylinder car at a modern price is becoming rapidly the biggest factor in British automobile engineering.

The numerous small models produced on every hand last season by the well-known manufacturers have been continued, and in addition many others have entered the ranks. Those who built cars rated as low as 7 horsepower for 1914 have in many instances increased the size of the motor and altered various features of design to bring the car up to a rating of 10 or 12 horsepower.

Some Two-Cylinder Types

The two-cylinder car which lost considerable ground in 1914 has lost more for this season, although several concerns such as Aldays, Enfield, Gordon, etc., still continue its manufacture.

Using Stock Parts

In analyzing the changes made for 1915 it is necessary to go deeply into the minor features of the cars, but there are a few marked trends in such features as ignition, cooling, etc.

SINGLE MAGNETO IGNITION IS EMPLOYED ON NEARLY 85 PER CENT. OF THE CARS MARKETED IN GREAT BRITAIN.

THE TENDENCY NOTED THIS YEAR ON THE PART OF THE MAKERS TO USE CARBURETERS MADE BY SPECIALISTS, INSTEAD OF THEIR OWN, HAS BEEN CONTINUED. WHILE SEVERAL OFFER OPTIONAL MAKES, FULLY 85 PER CENT. PROVIDE THEIR CARS WITH CARBURETERS MADE BY MANUFACTURERS WHO ARE ONLY IN THIS FIELD.

The movement toward worm drive is continued, and those announcing new cars are in a fair percentage of instances specifying worm drive as stock. The new Vulcan and the 11.9 Phoenix are good examples of this.

The Colonial Model

All the larger British manufacturers design their cars with an eye toward a distribution in the Colonies and foreign countries. British cars have a considerable sale in Australia, Canada, throughout Africa and in Russia, as well as South America. Requirements of these countries are different from those for home consumption. Rougher roads and steeper grades have resulted in the adoption of a colonial model in the lines of the important manufacturers. Concerns such as Argyll, Armstrong, Bell, Daimler, Napier, Sheffield-Simplex, etc., make a specialty of these models.

The colonial models have longer wheelbases, higher clearances, larger wheels and tires and bigger power plants. Throughout they are of heavier design, and while not equaling the chassis design for the English roads, in economy they are of more rugged structure with a corresponding longer life.

20 Per Cent. Are Sixes

THE SIX-CYLINDER CAR IS HOLDING ITS OWN. THE PERCENTAGE OF SIXES FOR THE BRITISH MANUFACTURERS IS NOT NEARLY SO HIGH AS IN THIS COUNTRY, WHERE APPROXIMATELY ONE-HALF THE CHASSIS ARE FITTED WITH POWER PLANTS OF THIS DESCRIPTION. OF THE CARS LISTED AS ON THE BRITISH MARKET, 20 PER CENT. ARE SIXES.

This proportion has not altered materially in the past season. It is significant that only one concern of importance has brought out a new six for this season. The specifications of the sixes that were on the market for 1914 have not changed materially, all the refinements being in the nature of body changes.

23 New Builders

In spite of the fact that only one new six is announced there are more than twenty-three new concerns which have made their appearance in the British industry. Most of these make small cars, fifteen of the twenty-three having motors that have a bore of less than 2.5 inches.

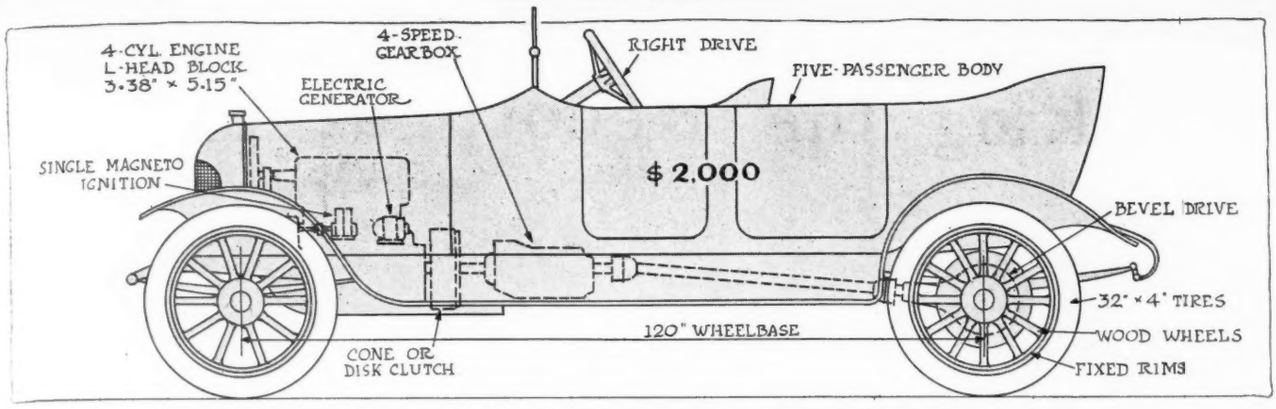
The number of concerns making cars this year has not materially increased, however, as according to the latest published reports there are fifteen who have not issued 1915 specifications. The discontinuance of the sale of Austrian and German makes in the British Isles has lessened the available supply of the larger cars, as in nearly every case cars imported from these two countries were of the heavy type with big power plants and capacious bodies.

Bodies Are Changed

Those companies that have announced their new models within the last 2 months, with very few exceptions have made their refinements in the bodies. This is not only true of the cars manufactured in the British Isles, but of those manufactured in France, which are generally announced at Olympia. The 1915 Darracq has been announced but is a direct continuation of the 1914 with the exception of body changes. The Humber has made no changes. Daimler continues to market the same two sixes and its four.

Typical British Car

Other companies have announced new models. A typical instance of a new car which brings out the trend of British industry very strongly is the Riley. It has a 2.48 by 3.46 motor with the four cylinders cast in a block. Mounted on a



The above chart is the car that would result were all the averages combined into one chassis

chassis of 96-inch wheelbase with a body of two-passenger capacity, it sells for $975. Thermo-syphon cooling, pressure-feed oiling, four-speed gearbox and 28 x 3-inch tires are used. The use of pressure-feed oiling and four-speed gearbox on a car of this size shows the strong line of demarcation between foreign and American practice.

Daimler is continuing the same lines of cars as in 1914 with the exception of improvements in the body work. Swift has a new car, bringing its line up to three chassis. The new model is a small four with a 2.48 by 3.54 motor, these dimensions being practically the same as those of the Riley. This car, while different in almost every particular, is an outgrowth of the two-cylinder light car marketed by this concern this season. The cylinders are block cast, lubrication is by pressure, and the axle a bevel gear.

New Napier Model

Napier has added to its range of models a chassis with a four-cylinder 3.5 by 5 motor. A feature of the chassis construction which illustrates a growing practice in British design is the use of tubular cross-members throughout. The engine, clutch and gearbox are in a unit power plant with three-point suspension. The cylinders are cast in pairs with the valves on the left and inclosed by a cover plate. In many respects the motor resembles American practice. The timing gears have helical teeth. Pressure lubrication is also used, and cooling is by thermo-syphon. The final drive is by an underhung worm, carried in double ball bearings with ball thrusts. The wheelbase is 124 inches.

Another well-known concern which has announced a new model is the Vulcan company. This again is an example of the low-priced car at $975 with a 2.67 by 3.93 motor. This concern has gone over to the method of incorporating the gearbox with the axle. In connection with this there is an overhead worm drive, and the tail end of the worm shaft has been selected to carry the drum for the service brake. This practice of mounting the brake drum on the rear end of the final drive shaft attracted considerable attention last year, and seems to be holding its own. An electric starting and lighting system is fitted to all the Vulcan chassis except this new model. The chain which drives the timing gears is adjustable, the magneto being carried in a brass tray, which also holds the bearings for the magneto drive pinion. By means of a screw the entire assembly can be moved to tighten the tension on the drive chain.

Star is another of the well-known manufacturers who put upon the market a new small car with a four-cylinder engine. The power plant is a 2.59 by 5 L-head block and follows the general practice of the British industry. Lubrication is by a combination splash and pressure system, cooling by thermo-syphon and the gearbox is a three-speed type.

The Calthorpe Minor is another of these small cars which, while introduced last year, has been considerably redesigned. It has motor dimensions of 2.44 by 3.54, and is a good example of how the makers have endeavored to secure more power from the small engines. The size of the valve has been increased, and also the bearing surfaces of the motor. The price of this car with acetylene head lamps and electric side and tail lights is $950.

New Wolseley Body

Wolseley has put itself on record as against the annual model idea, but from time to time changes are made as the cars are passing through the factory. A new open touring body is the latest addition. The bonnet has a slope and the cowl is of a streamline type with unbroken lines at the point of juncture to the bonnet. In the matter of equipment, a triple jointed windshield has been added and a ventilator which is the same as that used in marine work can be turned in any direction for ventilation of the forward compartment.

The Phoenix is also in the light car class, with its 2.71 by 3.93 cylinders cast in a block according to the universal practice of these small cars.

Another practice which is now common in cars of small piston displacement on the British market is the use of connecting-rods of H section.

The use of leather couplings for the magneto drive is continuing on the other side and is employed on this car. It is slotted to provide an adjustment. Another feature that is worthy of note is a detachable aluminum plate which is provided to afford access to the water-jacketing just above the exhaust manifold. A leather disk coupling is used between the clutch and the gearbox. Final drive is provided by an overhead worm, the worm wheel and the differential gear being contained in the same housing.

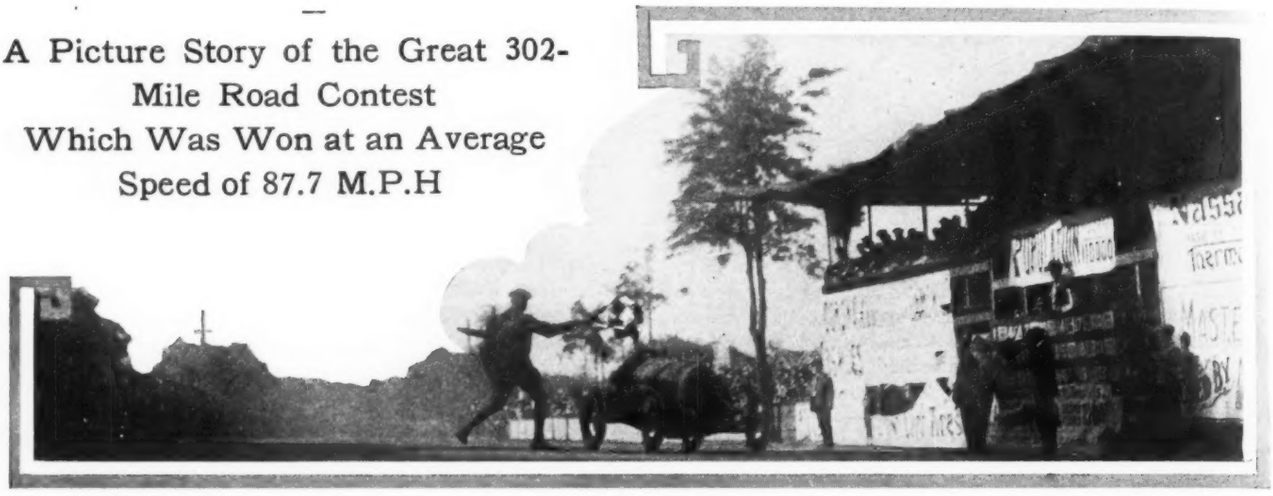
New Singer Model

A particularly good example of where a concern has developed a small car from a model which is still lighter is the Singer. The light car of last year has been discontinued and in its place a new model with a four-cylinder 3.14 by 5.10 motor. The L-head cylinders are cast in a block. American practice in the use of but two piston rings is another growing tendency on the other side and finds an example in the Singer. This motor also has an oiling system which is similar to that which is used in most American cars, the oil being taken from the reservoir in the crankcase to a dash gauge and then to the three main bearings. Oil is also fed to splash troughs which take care of the interior of the motor. Gasoline is fed by pressure from a little air-cooled pump driven by an eccentric from the camshaft.

One of the earliest concerns to announce a new 1915 model was Swift. The car is a four-cylinder 2.48 by 3.54 L-head design with the cylinders in blocks. This follows the general practice in this light class of car very closely, an interesting departure being made in placing the intake passage integral with the cylinder casting. The carbureter is bolted directly to the wall of the cylinder on the side opposite the intake valve.

Breaking the Record at Corona

A Picture Story of the Great 302-Mile Road Contest Which Was Won at an Average Speed of 87.7 M.P.H



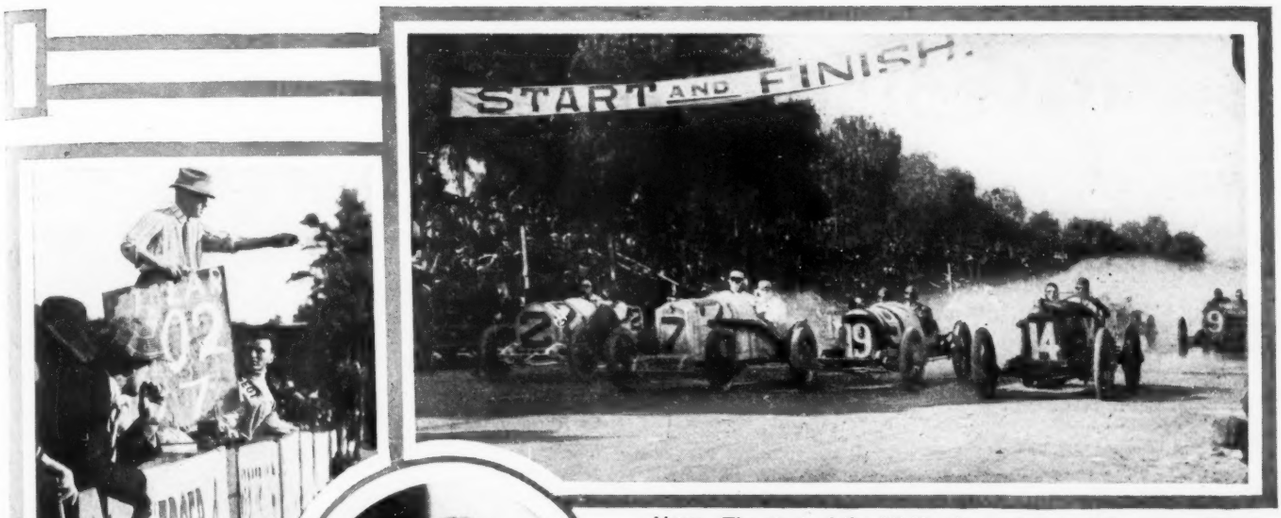
Starter Wagner giving Ed. Pullen in the Mercer the checkered flag marking the winning of the Corona race on Thanksgiving Day

A RACE in which the drivers averaged 98.6 miles per hour throughout the first thirty laps and which was finally won at an average speed of 87.7 miles per hour is bound to be of the greatest interest to every automobilist, engineer, manufacturer and dealer who takes the slightest interest in racing or in the lessons in car construction which are brought out by the gruelling grind of the road and track.

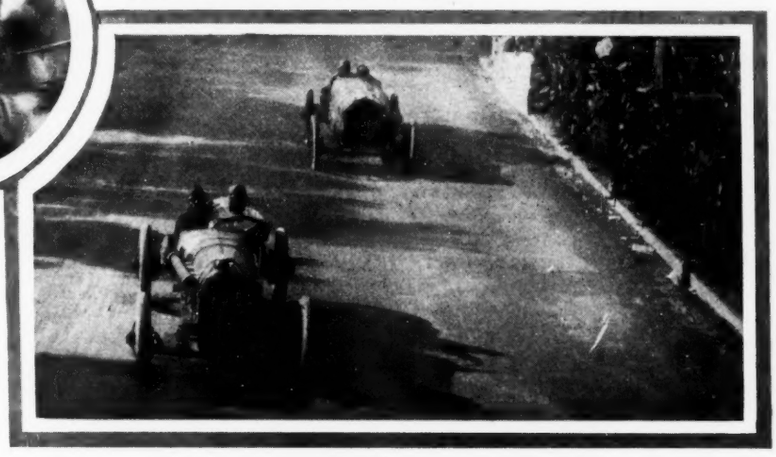
Herewith are illustrations reproduced from photographs of scenes at the great Corona Road Race held on Thanksgiving Day over a course 301.89 miles in length where the speed mentioned was attained as reported in THE AUTOMOBILE *for December 3, and where the first four drivers to finish broke the world's speedway record and the road race record as well. One of the features of the contest was the new non-stop record established by Oldfield's Maxwell, going through the entire race without making a stop of any kind.*

There were 100,000 spectators and around the course were parked 15,000 automobiles.

Cars and drivers at the starting point on the course just before the start of the 301.89-mile road race at Corona, Cal.



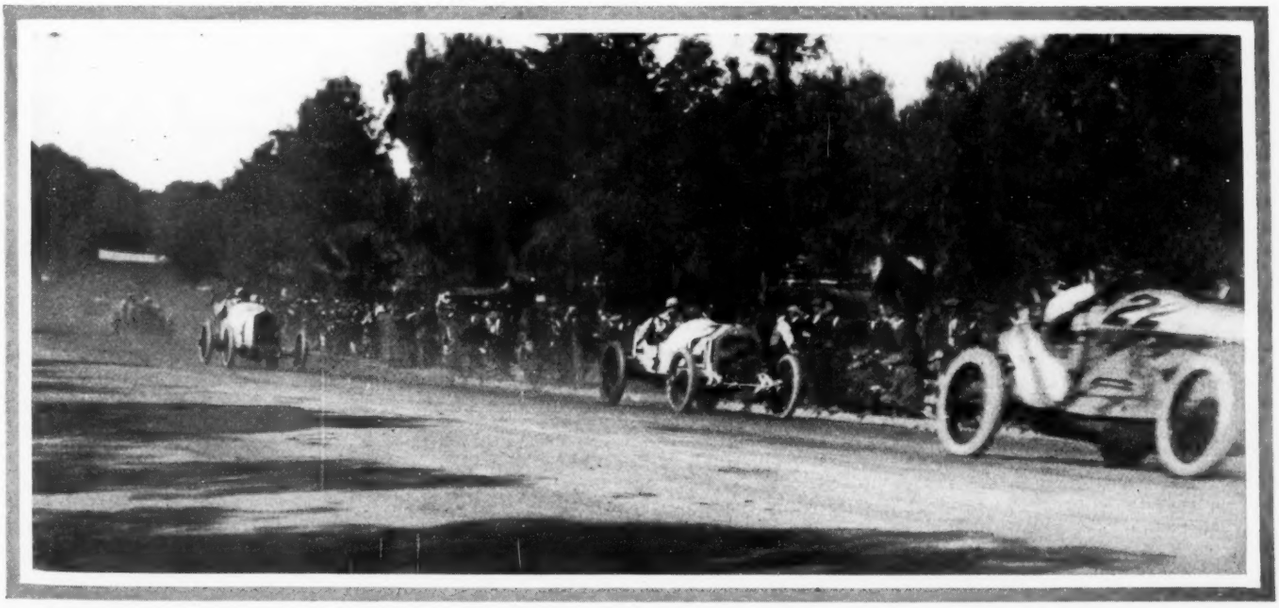
Above—The start of the 301.89-mile road race at Corona on Thanksgiving Day. Barney Oldfield's Maxwell has the pole. The flying speedway start was absolutely even



Above—George Bentel, manager of the Mercer team, signaling to Pullen on the course. Richenbacher is seen at the right of the signal board, his car having been disabled

Circle—Barney Oldfield, who finished second, establishing a new non-stop record, removes his cigar while he takes a drink of water

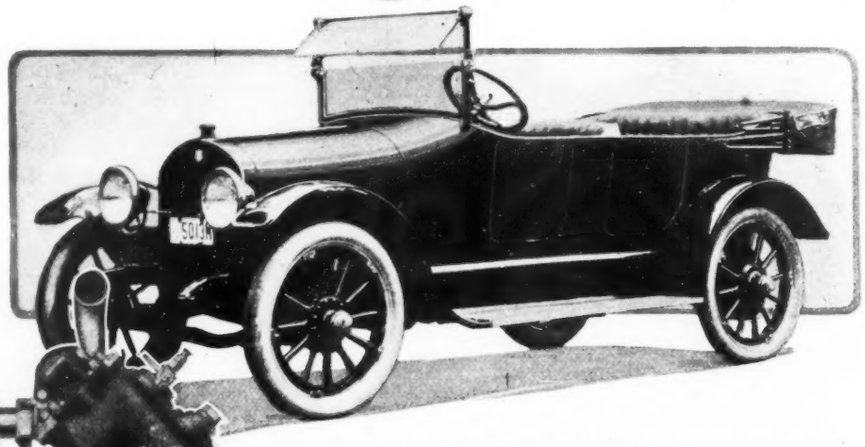
Right—Oldfield in the Maxwell passing Cadwell in the Marmon in an exciting part of the race. Oldfield, veteran of countless speed contests, admitted after the race that he never saw such a contest, the drivers circling the course like crazed demons, each carried on by the speed of the others, realizing that it was risky to do it and expecting an accident at every turn. Up to the thirtieth lap the speed average was 98.6 miles per hour. An idea of the tremendous pace maintained may be gained from the fact that the averages of the seven drivers allowed to finish varied from 87.7 to 77.2 miles per hour



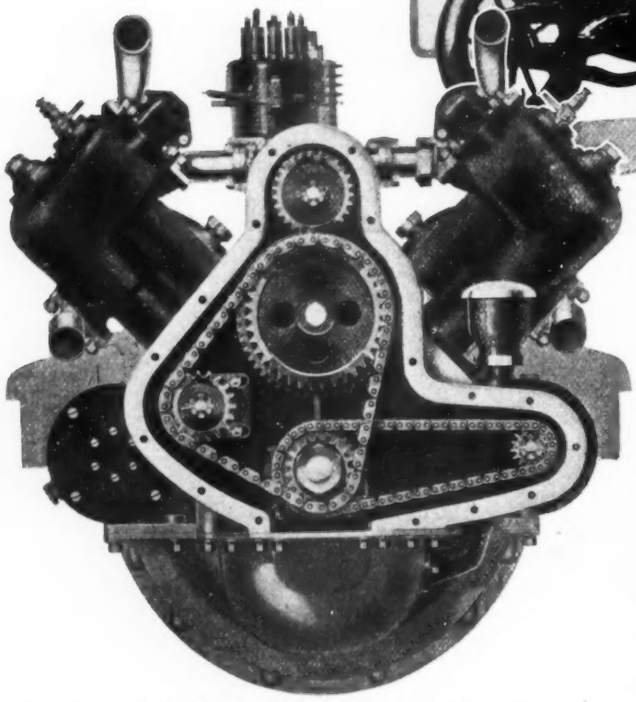
De Palma's Mercedes, Klein's Stutz, Richenbacher's Mercer and Oldfield's Maxwell in a speed brush in the tenth lap. All through the early part of the race the drivers averaged 98.6 miles per hour, rendering it intensely interesting to the 100,000 spectators

Eight-Cylinder King for $1,350

V-Type Motor 2 3-4 by 5—113-Inch Wheelbase— 15 Miles per Gallon of Gasoline



Eight-cylinder five-passenger King touring car, which, with complete equipment, electric starting and lighting, etc., sells for $1,350



Front view of King V-type eight-cylinder motor with timing gear cover removed, showing silent chain drive. Note mounting of ignition distributer in center; also note compact and accessible design of motor

TO the King Motor Car Co., Detroit, Mich., goes the distinction of placing on the market the second American automobile equipped with an eight-cylinder engine. This concern has designed a remarkably compact and accessible V-type motor with cylinders 2 3-4 by 5. This is installed in a chassis of 113-inch wheelbase, and sold at $1,350 with a roomy five-passenger touring body.

It is not surprising that another eight-cylinder machine should appear, for the popularity of this type is gaining and the merits of the construction are becoming well-known. Performance is undoubtedly the eight's greatest merit, this referring not only to flexibility but to fuel consumption as well, and there is a great class of buyers which takes kindly to any type of engine that will make necessary the minimum of gearshifting no matter how simple that operation may be.

It was demonstrated to the representative of THE AUTOMOBILE that the new King will start readily from a standing position in high gear, and it can be accelerated to 35 miles an hour from a speed equivalent to a slow walking pace within half a city block. Unofficial fuel tests show that the engine will run under ordinary conditions 15 miles on a gallon.

The general chassis design does not depart from that of the four-cylinder model. The gearbox, of three-speed form, is in unit with the engine, and other specifications include a propeller shaft inclosed within a torsion tube, floating axle, 33 by 4 tires and the special form of cantilever rear springs which have always featured King cars.

In designing its eight, the King company has adhered to the usual form in that the two blocks of four cylinders are mounted at 90 degrees to each other on the crankcase with valves facing. One is impressed with the accessibility of the parts. All tappets may be readily reached for adjustment, the carbureter being practically the only thing placed in the V between the cylinder blocks. The electric cranking and lighting units are carried on opposite sides of the crankcase, and the ignition distributer is mounted at the front of the space between and out of the way.

The stroke, 5 inches, is nearly twice the bore, 2 3-4 inches. The exact stroke-bore ratio is 1.82 to 1, and the piston displacement 237.5 cubic inches. Thus the advantages of a long-stroke are added to those of continuous turning effort. The motor operates at moderately high speed and this is accomplished by the use of light reciprocating parts along with well-balanced construction.

Power Plant Very Short

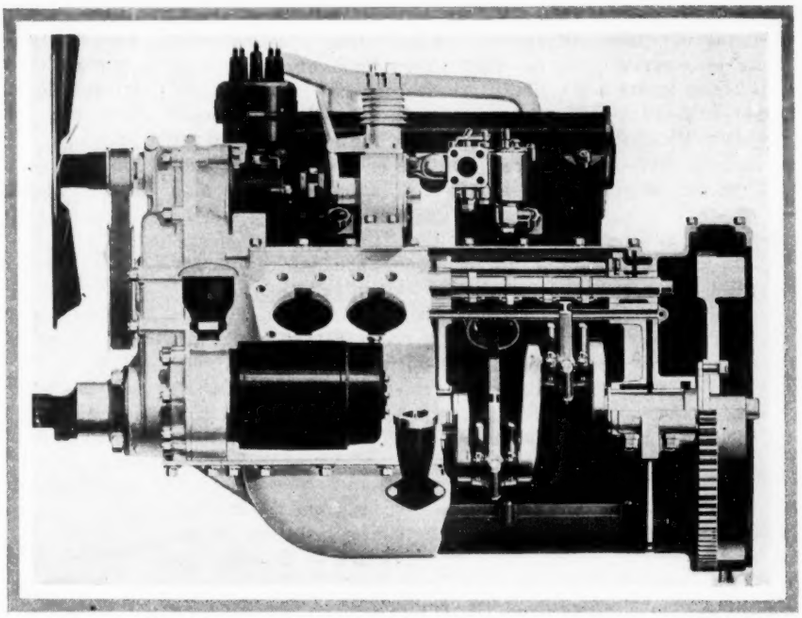
Compactness is also to be noted, for the power plant unit is really practically the same length overall as the four-cylinder King engine. In fact, for test purposes, one of these eights has been installed in a standard four-cylinder chassis without making any changes save the removing of the four-cylinder power plant. As a result of this compactness and lightness of parts, the engine is said to weigh approximately the same as the four. Of course, they are smaller cylinders, the four-cylinder motor having a bore of 3 15-16 inches.

In the general motor design, the aluminum crankcase is common to both blocks of cylinders, the upper half carrying the crankshaft, and the lower part forming the oil pan. The removal of this pan gives access to the bearings just as in any two-part crankcase design.

Yoke-End Rods Used

The crankshaft is a simple three-bearing type with the throws all in one plane, in fact, it is in the crankshaft that an eight of the V-type has a distinct advantage over a six. By coupling two connecting-rods to each throw bearing, it is possible to use a shaft exactly similar in form to that required for a four. In order to fasten the connecting-rods of

each opposing pair of cylinders to the same bearing, one rod has a yoke end, and the other rod is made with a small end which goes between the arms of the yoke. Each of these arms is provided with its cap to go around the bushing. Pins fasten the rod to the bushing so that it oscillates with the rod on the shaft bearing. The small-end connecting rod is free to move on the bushing, its bearing therefore being the outer surface of that portion of the bushing between the arms of the yoke. Both the main bearings and the connecting-rod bearings are babbitt-lined bronze. All have a diameter of 1 11-16 inch with the following lengths: front main, 3 inches; center main, 1 3-4 inch; rear main, 4 inches; connecting-rods, 2 3-4 inches.



Part sectional view of King eight-cylinder motor. The two rear cylinders on the left side have been cut away entirely to show the camshaft in the center of the engine and also the crankshaft and connecting-rods of the corresponding cylinders on the right. The two front cylinders are removed to show the mounting of the ignition distributer, the carbureter, etc., between the cylinder blocks

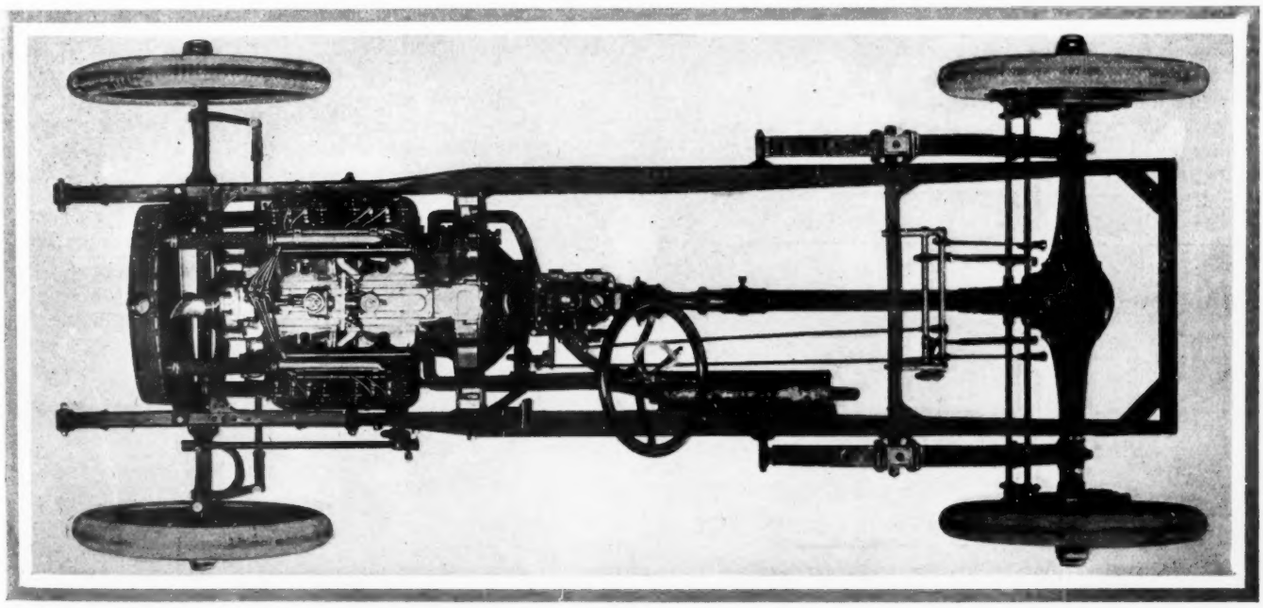
Access to Camshaft

The camshaft is mounted on three bearings vertically above the crankshaft. Its bearings are in the crankcase, and a plate bolting to the top of the crankcase between the two cylinder blocks gives access to the cam assembly. Like the crankshaft, the camshaft is the same type as would be used in a four-cylinder motor, having eight cams, each of which operates two opposite inlet valves or two exhausts. Pivoted to the crankcase are small rocker arms which go between the valve tappets and the cams. These are necessary so that the valve lift will be straight upward on the valves, the rockers through their small rollers bearing against the cams, taking the side thrust. The front camshaft bearing is phosphor bronze, measuring 1 inch diameter by 3 3-4 inches length. The center and rear bearings are of babbitt and their dimensions are respectively 1 11-16 by 1 3-4 inch, and 1 by 2 1-2 inches.

Valves are conventional bevel-seated types 1 3-8 inches diameter and 15-32 inch lift. With a motor of this kind where each cam does double duty in operating two valves, there is only one practicable timing, in which the inlets open at top dead center and close 45 degrees past bottom dead center, and the exhausts open 45 degrees before bottom center and close at top center. Intake and exhaust valves are interchangeable.

The camshaft is driven by a Link-Belt silent chain which in addition to working over sprockets on camshaft and crankshaft is carried over a small third sprocket to the right of the two main ones. This serves two purposes; first for driving the pressure oil pump, and second to give a means of adjusting the chain. The latter is accomplished by moving the small sprocket slightly to the right so as to increase the distance from the centers of this sprocket and the two main sprockets.

Back of the sprocket driving the camshaft and oil pump, the crankshaft carries another sprocket over which another chain runs to the left to the generator sprocket. The position



Plan of King eight-cylinder chassis, showing mounting of motor and gearbox, inclosed driveshaft, characteristic cantilever rear springs, rear axle, etc. Note duplicate water connections for cooling the two cylinder blocks. The thermo-syphon method is employed

of the generator may also be shifted slightly to take care of wear on this chain. On the camshaft and back of its sprocket there is a spiral gear meshing with a smaller gear which drives the ignition distributer shaft that is directly in line above both camshaft and crankshaft. As the distributer proper is vertical, a worm-and-gear mechanism transmits the horizontal drive into vertical. On the end of the horizontal part of the distributer driveshaft is a dog clutch which may be shifted to engage the single-cylinder tire pump on the top plate of the crankcase between the cylinder blocks. Chains and distributer driving gears are all completely housed by an aluminum plate, and they run in oil.

The carbureter is a specially-designed type having two openings, one connecting directly to the straight horizontal intake tube running to the single opening in each cylinder block. Distribution to the several ports is effected within the casting. The carbureter is fitted with a hot-air pipe, and gets its fuel from a tank carried at the rear of the chassis.

The Firing Order

The ignition distributer takes its current from the storage battery, and has hand and automatic control. In firing, the order alternates from one side of the engine to the other so that impulses will balance and an even turning effort result. Calling the first cylinder on the right No. 1, the second on the right No. 2, and so on, and considering the first on the left as No. 5, the firing order is 1, 8, 3, 6, 4, 5, 2, 7.

The motor is lubricated by pressure feed by means of the chain-driven pump which is of the gear type, and lifts oil from the oil base up through a horizontal supply tube lying along the inside of the crankcase, this delivering oil directly to each of the three main crankshaft bearings, from which it is forced through the holes drilled in the crankarms to the connecting-rod bearings. The center main bearing in this way delivers oil to rod bearings Nos. 2 and 3, while the front cares for No. 1 and the rear for No. 4. The oil thrown off by the crank bearings lubricates the cylinders and the camshaft bearings.

Thermo-syphon cooling is used. There are separate outlets and inlets from each cylinder block to the cellular radiator, which is aided in its work by a 16-inch fan. Free circulation is furthered by the 5-8-inch water space in the jackets. The absence of water pumps is a factor in securing simplicity.

The electric cranking and lighting system, of Ward-Leonard make, is a 6-volt two-unit type with the generator attached to the outer left side of the crankcase and driven at twice crankshaft speed by a silent chain. The cranking unit is on the right rear side of the crankcase next to the flywheel to which it connects in the usual way. There is no intermediate gear, the starter pinion meshing directly with the flywheel teeth. The ratio is 10.5 to 1; that is, the electric motor runs at ten and one-half times the velocity of the crankshaft.

In connection with the system a Willard 80 ampere-hour battery is placed under the right front seat, where it is readily accessible. The system operates on 6 volts.

Nothing new to King design appears in the chassis and drive system. Clutch and gearset are in unit with the motor, a bell-housing bolting to the flywheel housing by flange construction inclosing the mechanism compactly. The clutch, a multiple-disk type running in oil, has bronze plates against cork-inserted steel ones. The gearset is a conventional three-speed, selective type with its shafts carried on roller bearings. It has center control levers.

Floating Axle Details

The drive shaft is fitted with a universal at its front end, and back of it enters a compactly-designed torsion tube which is in unit with the pressed steel housing of the floating axle. This has a large cover plate at the rear to give access to the differential and driving gears. Ball bearings are used throughout the axle.

The braking system is of the usual external contracting service and internal expanding emergency type acting on rear drums, which are 14 inches in diameter by 2 inches wide. The brake operating rods are a part of the axle unit.

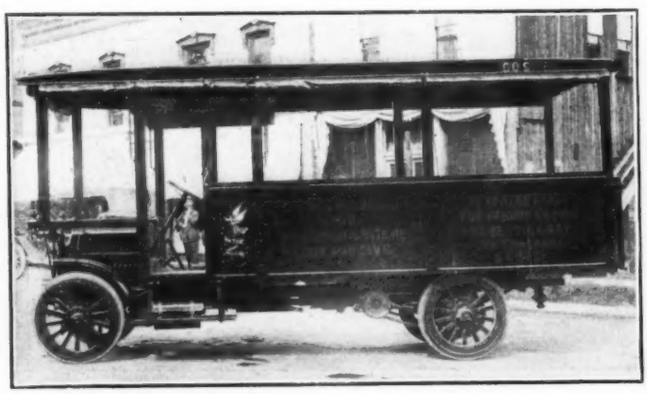
In this new car, the cantilever form of rear springs is still adhered to, the King company having used them since it brought out its first car some years ago. They have a trunnion mounting to the frame rail a little forward of the center of length, shackle at the rear to the axle housing, and at the front to the frame.

The frame is a bottle-neck design which is light and strong. Three cross-members in addition to the bracing given by the motor make it rigid. There is a slight kick-up at the rear to clear the axle.

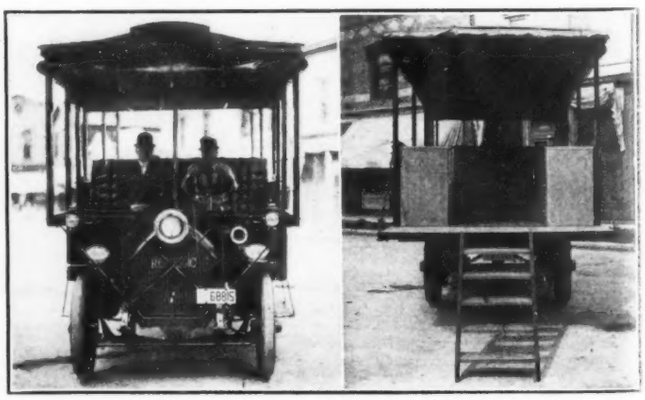
Alma Truck Used as a Gospel Wagon

Nowadays when the wise promoters of motor trucks as a commercial necessity have decided that they have been put to every kind of service imaginable, it is interesting to discover a new use for them. It has remained for one of the leading Evangelistic church organizations of the United States to press them into their service as "gospel wagons." Recently the Alma Motor Truck Co., Alma, Mich. was called upon to construct a special type of body on one of its standard truck chassis which would serve both as a home for the Evangelists and a pulpit as well.

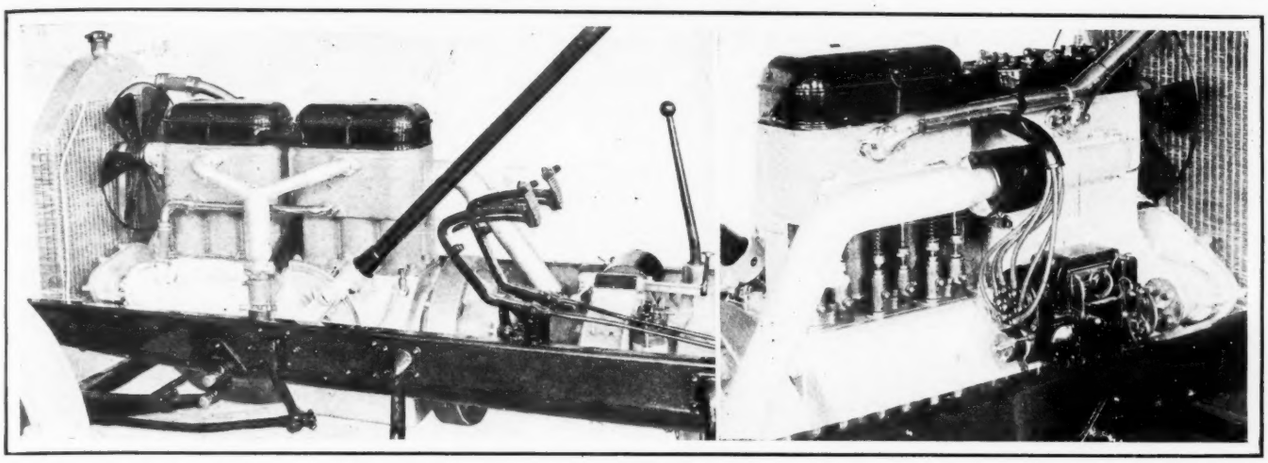
The truck was recently delivered and is now doing service throughout the South. Mr. Diehl, driver of the unique truck will travel all through Florida, Tennessee, Kentucky, Alabama and neighboring states spreading the gospel.



Side view of the Alma truck used as a gospel wagon



Front and rear views of truck, showing wide body



Reo six motor. Left view shows the left side of the motor illustrating the position of the carbureter, manifold construction and rack and pinion steering gear. The right view shows the valve mechanism and lighting and ignition generator mounting

Five-Passenger Reo Six for $1,385

Cylinders Cast in Threes and Cantilever Springs, Features —Price of Four Reduced to $1,050—Coupé Added to Line

A SIX-CYLINDER, five-passenger car with a wheelbase of 122 inches and selling at $1,385 will be made for 1915, by the Reo Motor Car Co., Lansing, Mich. In the main it follows the design of the Reo four, the two main points of difference being the complete inclosure of the valves and the adoption of cantilever rear springs.

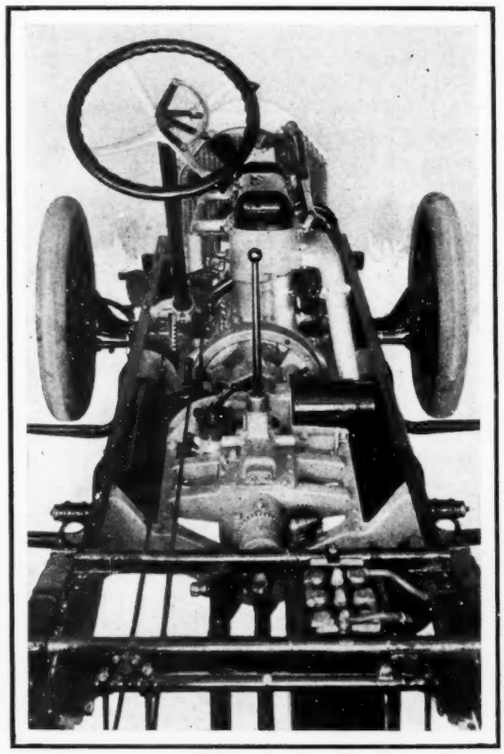
A substantial price reduction has been made on the four and a coupé has been added to the line which formerly consisted of two-passenger and five-passenger open cars. This year the price of both touring car and roadster was $1,175, but next year the touring car will sell for $1,050 and the runabout for $1,000. The coupé sells for $1,575.

Cylinders in Threes

In the six, cylinders are cast in threes. The bore and stroke are 3.563 by 5.125 which gives a piston displacement of 306.4 cubic inches and a stroke bore ratio of 1.43 which places this new Reo distinctly in the long-stroke class as distinguished from the new four which has cylinders 4.125 by 4.5 giving a ratio of 1.09. The S. A. E. rating is 30.4.

The chassis is divided into three units, the motor, gearset and rear axle being separate. The motor and gearset, following standard Reo construction, are mounted on a sub-frame. The electric equipment is furnished by the Remy company. The combined ignition and lighting generator is situated on the right side of the motor, while the starting motor is between the clutch and gearset. The wheelbase is 122 inches and the tires are 34 by 4. The tread is standard, being 56 inches.

The six motor has its cylinders cast in threes, and is supported at four points. These dimensions give an S. A. E. rating of 30.4 horsepower. It follows Reo construction in that the intake valves are situated in the head and the exhausts are on the right. This motor differs from its smaller brother, however, in that the rocker mechanism on the cylinder tops is inclosed by sheet metal covers held in place by two coil tension springs. Cover plates also inclose the push rods and valve stems. The crankshaft is carried on four main bearings and the camshaft on three. Both are one-piece drop-forgings. The camshaft is driven directly from the crankshaft by helical gearing. Cooling is provided for by a vertical tube radiator through which water is circulated by a centrifugal pump situated on the left side of the motor. It is driven from the crankshaft by a special pair of gears. The flow of air through the radiator is aided by a six-bladed belt-driven fan. Motor lubrication is by means of a circulating-splash system in which a plunger pump is used.

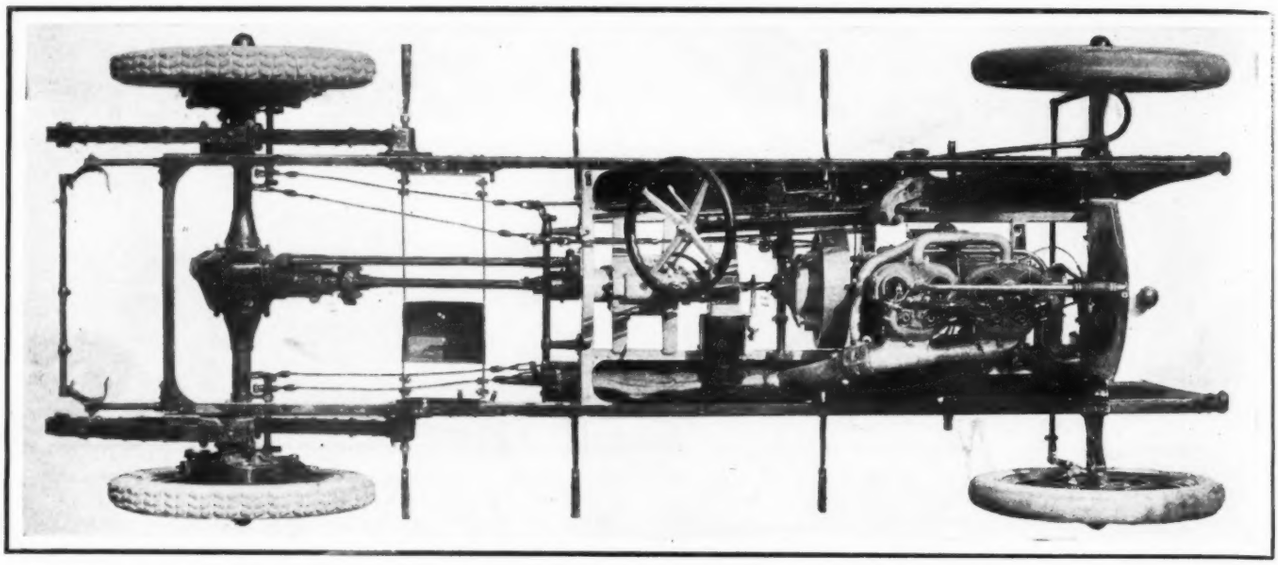


Reo six chassis, looking forward, showing the mounting of the control levers, the position of the starting motor to the right of the gearcase and the suspension of the storage battery from the frame

Mixture is supplied through a Johnson carbureter which is placed very low, a long water-jacketed manifold connecting it with the motor. Fuel feed is by gravity. Additional heat is supplied by means of a hot air connection on the exhaust pipe.

Remy Electrical Equipment

The electrical equipment consists of a 6-volt Remy two-unit system and a Willard 100-ampere-



Bird's-eye view of Reo six chassis showing the arrangement of the different members. Motor and gearset are suspended on the sub-frame from four points. The axis of the armature shaft is at right angles to the crankshaft and drives the motor through a worm gear. Since the driving gearing is behind the clutch the latter must be engaged when the motor is to be started. Note the cantilever rear spring suspension and the floating rear axle

hour storage battery. A single instrument combines the ignition and lighting functions. It is located on the right side of the motor and is driven through a leather coupling. The starting motor location is unusual in that it is placed just in front of the gearbox and to the right of it. It drives the engine through worm gearing and when cranking is to be done the clutch must be engaged, because the starter drive is behind the clutch.

The clutch is a dry-plate type and is situated in a housing bolted to the flywheel. The friction surface is steel against asbestos.

Three speeds are afforded by the gearset which is suspended from the sub-frame by four arms. The shifting lever is mounted directly on the top of the gear-case cover, which also contains the shifting rods. The gear lever is carried in a ball and socket joint. Hyatt roller bearings are employed in the mounting of both main and countershafts.

From the gearset the power is transmitted to the rear axle through a drive shaft fitted with two universals. A torque rod which is attached to a cross member of the main frame relieves the springs from the torque reaction of driving the wheels. No radius rods, however, are fitted, the cantilever springs taking the driving thrust. The cantilever springs are pivoted to the frame at their centers and are shackled at the front ends.

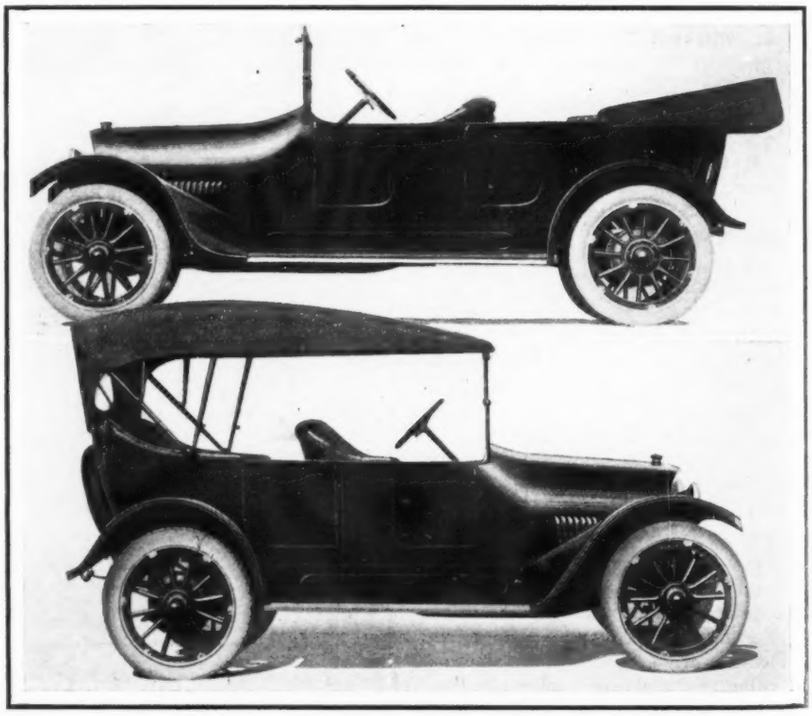
Floating Axle

The axle is a floating design, fitted with Timken bearings and notable because of the use of a spiral bevel gear and pinion to insure silence of operation. The ratio is 3.7 to 1. The brakes operate on the rear wheel drums which are 14 by 2.25 inches. The tires are 34 by 4 and are fitted with demountable rims which are mounted on wooden wheels. Front springs are semi-elliptic.

Left drive and center control have been adopted. The steering gear is a rack and pinion design. The emergency brake is controlled by the right pedal which usually actuates the service brake. This pedal is provided with a ratchet to hold it locked. The left pedal operates both clutch and service brake, the outward movement of the pedal first disengages the clutch and then applies the brake. This pedal is also provided with a ratchet lock.

The equipment includes a Stewart-Warner speedometer, one-man top with quick-detachable curtains, rain-vision, ventilating windshield, tools, extra rim, tire carriers, etc.

Smooth curves and clean running boards characterize the body design of the Reo six. As in this year's four, the top of the radiator points outward in a way that makes the car



Above—New Reo six. Below—Four-cylinder Reo with top up

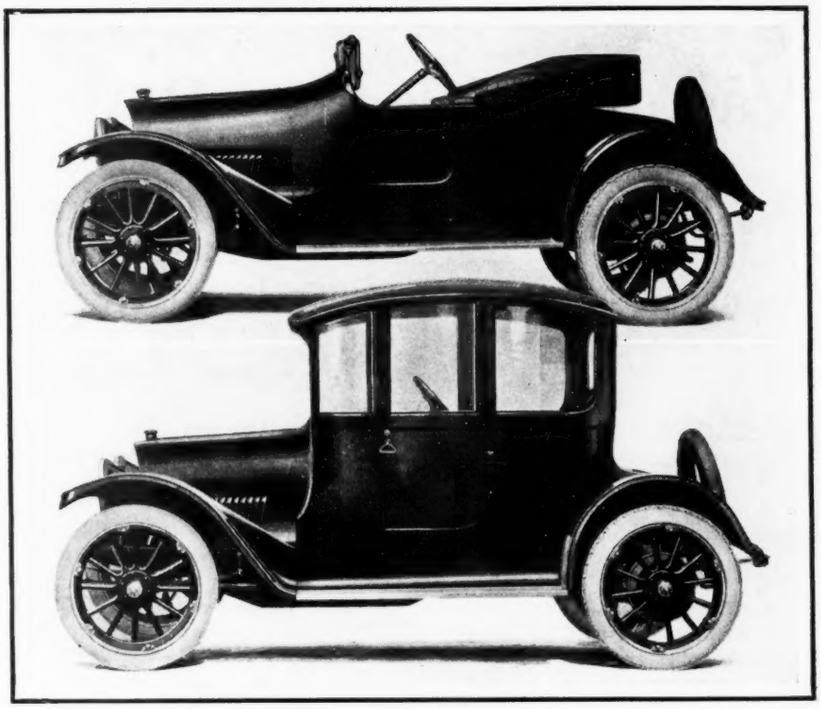
easily distinguishable. A feature is noted in the shaping of the front fenders. The inside of the fender is a straight line running to the frame, while the outside is curved to follow the wheel. This not only gives a pleasing effect, but also affords maximum protection against the spattering of mud. The smoothness of the body lines is accentuated by carrying the sides of the body down over the frame side members.

An increase of .125 inch in the bore is the principal difference in the new four. The cylinders now measure 4.125 by 4.5 inches, the S. A. E. rating being 27.2 horsepower. As in the case of the six, motor and gearset are mounted on a sub-frame, each being suspended from four points.

The cylinders are cast in pairs, the intake valves being mounted in the center of the head and the exhaust valves at the right side. Both crankshaft and camshaft are supported on three bearings, the camshaft being driven by helical gearing. Cooling is maintained by a tubular radiator assisted by a centrifugal pump and a six-bladed fan. Lubrication is by means of a circulating splash system in which a plunger pump is employed.

The electrical equipment is the same as that used on the six, while the carbureter is a Holley. The intake manifold is not water jacketed but a hot air pipe is fitted. Fuel feed is by gravity from a 16-gallon tank under the front seat.

The clutch and gearset and the mounting of the electrical units are the same as on the larger car. Drive is transmitted to the rear axle through two universals, and a torque tube is fitted. The gear ratio is 4 to 1. The rear axle is a semi-floating design on which are mounted three-quarter elliptic springs. The brakes eare 14 by 2 inches, both sets acting on the rear wheel drums. Timken and Hyatt roller bearings are used in the rear axle and in the front axle Timken bearings are used exclusively.



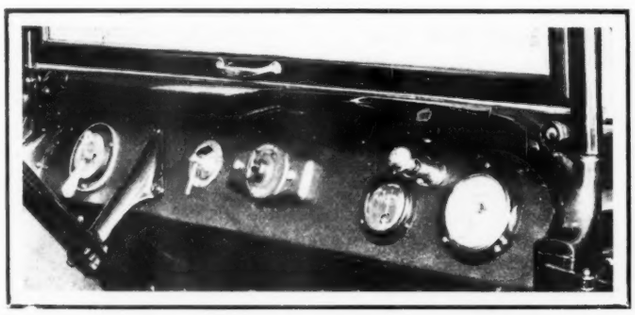
Upper—Reo four runabout. Lower—Reo coupé

The equipment includes a Stewart-Warner speedometer, three-bow extension top with quick-detachable curtains, rain-vision, ventilating windshield, tools, extra rim, tire carriers, etc.

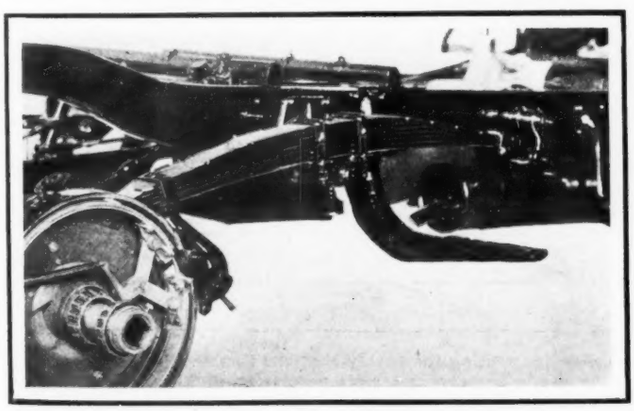
The body design of the four resembles that of the six and follows Reo design of this year except that the shape of the rear door is fuller, instead of the lower rear corner being cut off to make room for the fender.

Four Body Like Six

The body on the new runabout is the same as that of this year, but with slight refinements which add to its appearance. The coupé is a design in which the details have been thoroughly worked out. The upholstery is cloth and the windows are frameless. A rain-vision glass front allows the driver to see the road properly even in rainy weather. There is a space at the rear for tools and tubes and back of this is the tire carrier and spare rim.



Arrangement of instruments on Reo cowl board



Reo six cantilever spring suspension showing how it is pivoted at its center and shackeled at its front

Vanadium Discovered Near Lake Superior

DETROIT, MICH., Dec. 7—Vanadium has been discovered by J. N. Thompson, a mineralogist, near the shore of Lake Superior, about 35 miles northwest of L'Anse, it is reported.

The mineralogist has been prospecting for a number of Chicago iron interests and made the discovery of a vein of vanadium several weeks ago. The matter was kept secret, but arrangements were made at once for the construction of a shaft and crew of men was put to work to further investigate the grounds. The vein is reported to be 24 inches thick and runs for a very great distance. In fact it is estimated that the output will be exceptionally large in quantity and value. Although vanadium has been found in five Western States, in only two has it been found worth the while to mine it, but even so, the quantity produced is quite small and practically all of the vanadium used in the United States comes from Europe and most of it from Sweden.

Vacuum-Velocity Ratio Not Constant

The Automobile Engineers' Forum

Carbureter Inventor Cites Simultaneous Readings in Mixing Chamber and Venturi Throat as Basis of a Mathematically Designed Instrument

NEW YORK CITY, Dec. 5—Much discussion has arisen over the principles of operation in the new Browne carbureter recently described in these pages and A. B. Browne, inventor of this carbureter, answers many of these criticisms in the following communication and shows wherein the carbureting conditions in his design differ from those in other types:

BRANFORD, CONN.—Editor THE AUTOMOBILE:—In discussing the principles used in the Browne carbureter we must first recognize that in the ordinary auxiliary-valve carbureter, the force acting on the valve is not the same as the force acting on the mouth of the fuel jet.

In proof of this, turn a stream of compressed air through the primary inlet of any carbureter. Fuel will be inspirated by the velocity of the air passing the fuel jet, although the pressure in the carbureter is above, rather than below, that of the atmosphere. This is the well-known principle of the atomizer. Because the pressure within the carbureter is above atmospheric, the common auxiliary valve is pressed tightly against its seat.

If now, suction is applied, instead of pressure, and the primary inlet closed, fuel will again be inspirated, this time by the static vacuum, for because the inlet is closed, there will, in this case, be no air passing the fuel nozzle to exert its inspirating effect. In this case the auxiliary valve opens.

Velocity and Vacuum Actuate Fuel Flow

By these two experiments we have proved that the fuel flow is actuated by velocity and vacuum while the auxiliary valve operates by vacuum alone.

It is next necessary to prove that although the vacuum induces the velocity, that:

A—The combined forces of vacuum and velocity are greater than either acting alone.

B—That the relationship between the two forces is not constant.

In proof of A, I cite actual simultaneous readings of injecting force in inches of water.

On the auxiliary valve in the mixing chamber	On the fuel at the throat of the venturi
0.5 inch	1.31 inch
0.875 inch	1.93 inch
1.0625 inch	2.875 inches
2.5 inches	5.5 inches

B—The foregoing readings were taken during a period of no barometric or temperature change and hence the relationship remained practically constant.

Suppose, however, as an exaggerated illustration, that in one case the velocity over the fuel jet was that of entering air while in the second case it was that of mercury vapor. The vacuum in both cases could be maintained the same but the velocity effect of the heavier mercury vapor would be very different from that of the lighter air.

This is clear, mathematically, when we remember that density is a factor of head and that head is proportional to the square of the velocity and not velocity direct.

Constantly Varying Factors

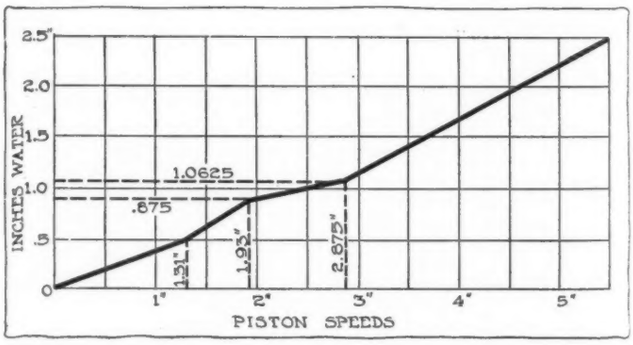
Summarized then, we must admit that there is no constant kinetic characteristic of air, so far as carburetion is concerned. Temperature, pressure and consequently volume, are constantly changing and hence the relationship between the forces acting on the fuel nozzle and upon the auxiliary valve are constantly varying. The best we can do is to eliminate this variation instrumentally, by causing the same forces, whatever they are, to act on both fuel and air supply. This the Browne does and, repeating our first experiment as above, we find the flow of compressed air actually opens the auxiliary valve instead of forcing it shut as in the ordinary carbureter.

Velocity Determines Curve of Inlet Areas

Having accomplished elimination of variables it becomes an easy matter of design to so proportion the total air inlet area as to maintain constancy of composition. Both the primary and auxiliary inlets must be considered as a unit, but in the Browne, because of greater mechanical convenience, the total area is properly modified by varying the auxiliary inlet only, and inasmuch as the varying degrees of vacuum are fixed, velocity alone enters into the determination of the curve of inlet areas.

Because the areas corresponding to given quantities of air can be and are so accurately determined, it becomes necessary to use a spring accurately calibrated for each instrument, precisely as the spring of a spring balance is calibrated. This is done by passing compressed air through the primary inlet at velocities determined by a venturi meter.

This accuracy would be unobtainable with differing air densities if the disk-type valve were used. The inertia, or the wind, of the incoming air at different densities would change the position of such a valve relative to the curve of



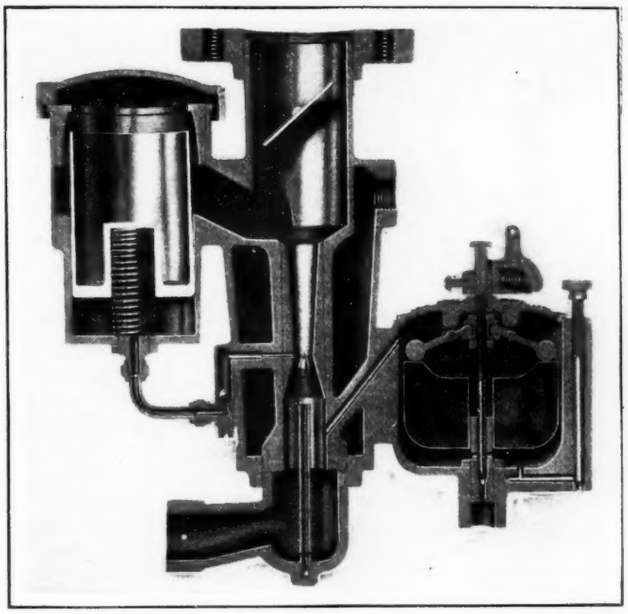
Curve illustrating the theory that the combined forces of vacuum and velocity in a carbureter are greater than either acting alone, as deduced from a test comprising actual simultaneous readings of injecting force in inches of water on the auxiliary valve in the mixing chamber and on the fuel at the throat of the venturi

admission areas and hence our valve is made cup shaped, presenting practically no surface to the inrushing air. In effect this is an adaptation of the bug used by Western miners where a candle inserted through the side of an open ended can, fails to be blown out, even with a stiff gale blowing directly into the open mouth of the can.

Keeping Out Dirt and Preventing Air Leaks

One more point is worthy of consideration. The air current passing from the auxiliary opening in the mixing chamber traverses a path at an approximate right angle to the vertical axis of the valve. The velocity is here again utilized to exert a suction where the valve enters its cylinder, in this way preventing dirt from entering and counteracting possible air leakage past the valve. The effectiveness of this is proven by the fact that I have driven one of these carbureters 16,000 miles, with no cover on the auxiliary opening, and the valve today is nearly as bright as when first put in, and shows not the slightest sign of wear.

Our instrument is the embodiment of a conception of natural law and frankly I have spent the greater part of 3 years attempting to prove some weakness in this conception but absolutely without success. Deviations always led us directly back to the original basis and this given, design was a simple matter.—ARTHUR B. BROWNE, designer of the Browne carbureter.



Section through Browne carbureter, which has vacuum air contro

Court Decisions—Motorist Recovers Damages

By George F. Kaiser

THAT a purchaser of a motor car on his rescission of the purchase for false representations is entitled to recover back the entire amount he paid for the car, although part of that amount was given as a commission to agents, was recently decided by the highest court in Texas.

In 1913 a motorist, desiring to get a better and more up-to-date car than the one he owned, applied to a garage owner in the town where he lived and told him that he was impressed with a certain car and, although the latter was the agent for another car, he undertook to get the agency for the car desired.

The garage man took the matter up with the agents of the factory and was told by them that if a commission was made they would divide it. He succeeded in selling a new car to the motorist and allowed him $550 for the old car in part payment. The new car was represented to be a four-cylinder, four-passenger, 30 horsepower car, first class in all respects, and a good hill climber and able to go from Dallas to Celeste on high gear. The car turned out to be defective and not as represented. The purchaser therefore attempted to rescind the contract and get back the money which had been paid by him.

The Court held that he was entitled to do this notwithstanding the fact that $200 commission had been divided between the garage man and the agents.—*Halff vs. Jones*, 169 *S. W.*, 906.

Must Stop After Accident

California Court of Appeals decides that motorists must stop and give their addresses whenever an accident occurs.

California has a statute somewhat similar to the statute in New York and other states, which provides that whenever an automobile strikes a person or collides with another vehicle, the driver shall stop the automobile, attempt to give assistance to the other vehicle and furnish the number of the offending car, together with the name and address of the driver and owner and the names of the passengers.

While a car was being operated by a motorist in California, it collided with another automobile and the chauffeur of the first car did not stop, nor give his name, number, etc. He was convicted of violation of the above statute and it was held that his argument that such a collision might occur under such circumstances as to render him criminally liable and that therefore the statute was unconstitutional could not avail him, as it was the right of the Legislature of the state to attach any restrictions or conditions to the operation of motor car vehicles on the highways that it thought necessary.—*People vs. Diller*, 142 *Pacific* (*California*), 797.

Chauffeur Acting for Owner

When a person seeks damages from an automobile owner whose car is driven by a chauffeur at the time of a collision, he must set up that the chauffeur is acting for the owner at the time of the accident.

A person was struck and injured by an automobile which was driven by the owner's chauffeur and subsequently he brought suit against the owner for damages for his injuries. The Court held that the action against the motorist could not be sustained because although the chauffeur was named, the injured party did not allege that at the time of the accident the chauffeur was the motorist's servant, or that the chauffeur was acting for the owner at that time.—*Ruban vs. Bierman*, 149 *N. Y. Sup.* (*New York*), 483.

NEWCASTLE, IND., Dec. 7—The fact that an automobile dealer has machines on the freight track, with a sight draft attached to a bill of lading does not in any way impair his financial credit. This point was brought out in receivership proceedings at the Henry Circuit Court here. Charles W. Mouch, president of the Farmers' National Bank of this city, and a minority stockholder in the Rose City Auto Co., filed a petition for the appointment of a receiver for this company. Judge Fred C. Gause, in an oral decision handed down, refused to appoint a receiver and stated that the corporation was entirely solvent, the evidence showing a healthy condition of affairs.

The Improvement of Spring Suspension—II

By M. C. K.

(Continued from issue of November 26)

The basic idea: To express the requirements in the springing of motor vehicles in definite mechanical terms; to do this by ascertaining and describing the movements and actions occurring under different conditions and comparing them with those desired; to ignore refinements until the fundamentals seem clear—in brief, to make the subject accessible.

IN trying to determine the movements to which a vehicle is subject by reason of inequalities of the road surface, with a view to ascertaining the best means for getting only such movements as are consistent with security and comfort, it is found necessary to examine first (1) the movements made by a vehicle entirely devoid of spring suspension elements of any description, then (2) those of a vehicle fitted only with ordinary vehicle springs, thereafter (3) those of a vehicle fitted with springs and elastic tires and finally (4) those of vehicles equipped with springs, elastic tires and representative selections among the auxiliary devices which have been developed specially for the requirements of speedy motor vehicles. In this instalment only a part of the foundation for subsequent comparisons can be laid, consisting in an examination of the action which must follow when an entirely unelastic vehicle strikes an obstacle of the simplest shape on a level road. As entirely unelastic vehicles do not exist in reality, the result of this preliminary examination cannot be anything more than a contribution to the clearing up of the ideas which subsequently enter in the more practical phases of the large subject. It should, however, dispose of the rather widespread impression, which is frequently countenanced unthinkingly even by those who are deeply versed in other aspects of spring suspension matters, to the effect that the jouncing and the shocks of vehicles, which are both sources of danger and discomfort, are also due to the same causes and can be obviated by the same means.

In each of the four classes not only the movements caused by simple road obstacles but also those caused by depressions in the road surface and by successions of humps and of hollows at various distances apart, as well as of humps and hollows in combination, must eventually be considered with reference to different vehicle speeds and road gradients, but this will be postponed until the more fundamental comparisons shall have been disposed of; whereafter the reasoning becomes easier.

(1) Movements of Vehicle Devoid of Springs and Other Elastic Elements

The suppositions are: A vehicle weighing 3,000 pounds, of which the rear wheels and axle with the load thereon represent 2,000 pounds and the front wheels and axle with load make up the remaining 1,000 pounds; the wheels are 40 inches in diameter; a speed of this vehicle of 50 feet per second, which corresponds to about 35 miles per hour; a level road with an entirely unyielding transverse ridge of triangular section, 3 inches high with a base of 6 inches.

What happens to an absolutely unelastic vehicle when it strikes a road obstacle is not unlike that which happens to the running-gear, with hard tires on the wheels, of a motor truck for example, if the action of the running-gear is considered separately from that of the springs and the load supported on it; that is, the forces are similar, but the resulting movements are made to vary through the reactions of the load and the springs upon the running-gear; also, the running-gear is in practice never absolutely unelastic. The similarity nevertheless becomes of interest in the subsequent development of the subject and especially for a comparison of the relative merits of two spring suspensions, one composed of ordinary vehicle springs eased by means of elastic tires and the other of more specific spring arrangements in connection with tires of scarcely any elasticity.

The laws of gravitation must be constantly consulted to determine the movements of the vehicles in all four classes. For convenience there is therefore given herewith in Fig. 2, a scale of the time t in fractions of a second which it takes for a weight to drop back to the level of a road from different heights h. It gives the time for heights from 1 inch to 12 inches, and thereafter for even feet from 2 to 16. In figuring this scale and in all other cases, the factor of acceleration by gravity, g, has been taken as 32 instead of 32.16 or 32.20, this giving $t = 1/4\sqrt{h}$ from the basic formula, $h = 1/2gt^2$.

Gravitation Data

Acceleration by gravity $= g = 32.16$ feet per second
Time in seconds $= t$
Velocity acquired $= v = gt$
Height of fall or rise $= h = \frac{1}{2}gt^2$
Initial velocity $= c$
Height of rise against gravity $= h = \dfrac{c^2}{2g}$
With g taken as 32, $t = \frac{1}{4}\sqrt{h}$

SCALE OF $t = \frac{1}{4}\sqrt{h}$ FOR DIFFERENT VALUES OF h

h	t	h	t
1 inch	0.072	3 feet	0.434
2 inches	0.102	4 feet	0.500
3 inches	0.125	5 feet	0.559
4 inches	0.145	6 feet	0.612
5 inches	0.161	7 feet	0.661
6 inches	0.177	8 feet	0.707
7 inches	0.191	9 feet	0.750
8 inches	0.204	10 feet	0.791
9 inches	0.216	11 feet	0.829
10 inches	0.228	12 feet	0.866
11 inches	0.239	13 feet	0.901
1 foot	0.250	14 feet	0.935
2 feet	0.353	15 feet	0.968
		16 feet	1.000

Fig. 2—Reference formulas and figures related to the movements of vehicles in rising from or returning to the road level after a shock

Beginning with front wheel action, to climb the ridge means to raise the weight of 1,000 pounds to the height of 3 inches in the time elapsing from the moment when the wheels strike the ridge till they are squarely on top of it. For simplicity, the two wheels may hereafter be referred to as one.

By reference to Fig. 3 it is seen that the distance covered by the vehicle in this time is b and that this is one side of a right-angled triangle; hence $b = \sqrt{20^2 - 17^2} = \sqrt{111} = 10.53$ inches.

Moving at the rate of 50 feet per second, and considering that retardation due to the shock received by striking the ridge is negligible, the vehicle covers 10.53 inches in 0.01755 second and imparts an upward movement of 3 inches to the front portion of the vehicle.

At this point in the reasoning the current opinions part, and for the sake of clearness the view of the action most commonly entertained must be presented first. According to it, it is assumed that the upward movement at high velocity results in a bound and that the extent of the bound—the vertical movement being so far the only component considered—depends on the velocity. The height of the bound is in this manner easily figured:

It is determined from the formula, $h = \frac{c^2}{2g}$, in which c is the initial speed in a vertical direction imparted to an object and h the total height reached by the object with gravitation constantly acting against its rise. In the present case $c = 3$ inches in 0.01755 second, which is the same as 171 inches or 14.25 feet in 1 second. The formula thus gives:

$$h = \frac{14.25^2}{64} = \frac{203.0625}{64} = 3.18 \text{ feet.}$$

The front portion of the vehicle is thus thrown up in the air to a height of 3.18 feet, if it may be assumed that its connection with the rear portion does not hinder or assist the movement.

The time occupied in going up is the same as for coming down again, as the velocity decreases in going up exactly at the same rate as it increases in coming down. The drop from a height of 3.18 feet, (according to: $t = 1/4\sqrt{h}$ or by interpolation from scale in Fig. 2) takes 0.445 second, and the total time of the bound is therefore 2×0.445 sec. $=$ 0.890 sec. This gives the width of the leap, for in 0.890 second the whole vehicle advances—still on the supposition that its momentum is not appreciably reduced by the impact—at the rate of 50 feet per second, consequently a distance of $50 \times 0.890 = 44.5$ feet, and the movement made is therefore a leap 44.5 feet long and 3.18 feet high, describing a parabola.

Before the front portion has finished this leap, the rear wheels strike the ridge, and this causes the rear portion to make a similar leap, so that the whole vehicle is in the air for a distance of 44.5 feet minus the length of the wheelbase.

Misapplied Reasoning

These figures seem extraordinary, but it is remembered that racing cars, after striking a *caniveau*, have sometimes made leaps described as even more wonderful, and some explanation is perhaps found in the assumption of completely unelastic wheels and vehicle structure acting against an entirely unyielding obstacle, it being remembered that in any sort of practice where no springs are used, as for artillery, for sulkies or in the Russian telega, large forces are always absorbed, in the case of a shock, in deformations and heat generation, while the road obstacle is also more or less crushed by the impact, so that the forces remaining to cause a great bound with these vehicles are considerably cut down. In the discrepancy between theory and practice an explanation has thus been found for the observed fact that unsprung vehicles after all do not make such leaps as described. But there is little comfort in this explanation, because only the velocities and not the masses have been considered in figuring out the trajectory of the vehicle after striking, and it follows from this that the leaps made in practice should equal those declared by theory with only an extra allowance in the matter of the severity of the conditions. For example, a hard obstacle, such as a scantling or a frozen ridge or a railway track 5 inches high, should under that explanation have a similar effect on the trajectory as a theoretical hump 3 inches high.

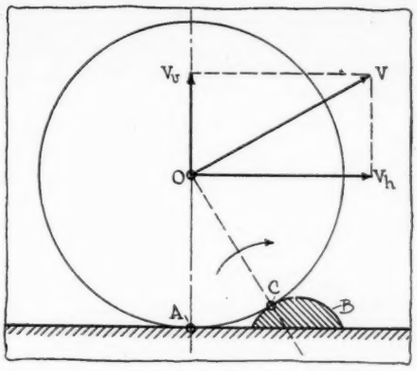


Fig. 4—Dr. Bobeth's illustration

Even Specialists Confused

That the theory which would determine the bouncing of a vehicle from the velocities employed and the height of the obstacle encountered is not purely a popular fallacy or set up merely as a man of straw to be knocked down, is evidenced in one instance. Dwelling on the severity of the vertical component of a road shock, Doctor-engineer Erich Bobeth, whose treatise on *Die Leistungsverluste und die Abfederung von Kraftfahrzeugen* (The Efficiency Losses and the Spring Suspension of Motor Vehicles), 1913, constitutes the most recent exposition of spring suspension requirements and is based on many elaborate tests, has the following to say (page 70 of the work mentioned): "If in accordance with Fig. 37 [reproduced as Fig. 4 in this text] it is assumed that a wheel moves with uniform horizontal velocity v_h and, when reaching the point A, meets the obstacle B, it is compelled to leap over this obstacle. At the moment of striking, the wheel must execute a turning movement around the point C of the obstacle. If the wheel has a perfectly rigid tire and the horizontal speed v_h is to remain constant during the leap, there must at the moment of striking be created a vertical velocity v_v of finite magnitude determined by the parallelogram of forces, while before the striking the vertical velocity was nil. This means however that the acceleration of the wheel in the

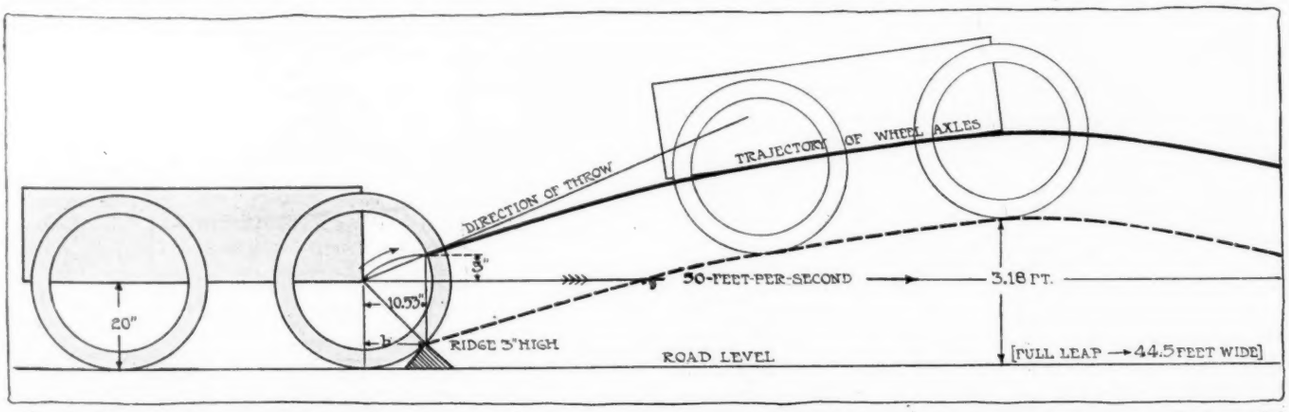


Fig. 3—Representing a graphic translation, based on figures, of a commonly accepted theory, as to what occurs when a fast-moving vehicle without springs or elasticity strikes an obstacle in the road—Not drawn to scale—Curve marked by arrow is part of the wheel axle trajectory, and the lack of continuity where the two portions join suggests the error of the theory

vertical direction must be infinitely great [since O must be multiplied by infinite to produce a finite value]. And an infinitely great acceleration calls for infinite forces, which cannot exist in practice; moreover, destruction of the obstacle or the wheel is first to be looked for.

"It was assumed in this reasoning that the horizontal velocity v_h of the vehicle frame and axle remained unchanged while the wheel passed over the obstacle, and this supposition is generally justified, as the mass of the vehicle is of such magnitude that the retardation at the moment of the shock can be considered as negligible.

"There exist, however, vehicle constructions with which a momentary retardation of the axle with relation to the frame is possible; namely by the use of resilient radius rods [or "driving through the springs"]. The velocity v_h of the axle can then become O at the moment of impact, and this will permit also the vertical velocity v_v to begin at O and to increase gradually, so that excessive vertical acceleration is avoided. It must nevetheless be considered that even with such construction the relative movement of axle and frame is very small and that therefore the mitigating effect of yielding axle struts must be small also.

"A suitable means for holding the vertical acceleration within bounds while the horizontal velocity remains constant [so as to avoid jerky progress] is found in the use of elastic tires. The obstacle impresses itself in some measure in the tire, and the vertical forces, beginning with O, are increased gradually and impart to the axle likewise a gradually increasing vertical velocity."

Dr. Bobeth does not trace the trajectory of an entirely "unsprung" vehicle and perhaps by reason of this omission is not induced to investigate further if the theory of the vertical acceleration due to the shock, which he applies and which is the same that has been applied to construct Fig. 3, is after all properly applicable for any kind of vehicle, with or without spring suspension and tires.

In what else there has been published on the subject similar uncertainty and hesitation prevail on this point, the theoretical conclusions being apparently hard to accept, as they should be, but the hesitation may be ascribed in part to the fact that unsprung vehicles have seldom been seen running at 35 miles per hour against hard obstacles 3 inches high, so that the actual results of such practice are little known. The impact would result in breakage in most cases. Also, a slight reduction of speed, which might escape the estimate in practice, figures out a considerable moderation in results. The writer remembers, however, one instance which might be interpreted either way. A cannon under his command was driven at the highest obtainable horse speed down a steep hill and struck a ridge, higher at one side than at the other, near the foot of the slope, and the leap made was astounding in height, throwing the soldiers a considerable distance, while the unevenness of the shock resulted in twisting the steel plates of the carriage probably 10 degrees.

Reasoning for True Theory

As it is evidently of considerable importance to know what actually does or must take place, with different sorts of impacts, in the case of unsprung vehicles, so as to be better able to appreciate the effects of spring suspension elements, an attempt shall now be made to determine if there is not after all a momentary retardation or other factor of some magnitude at the reception of a shock, which will allow the trajectory described by an unsprung vehicle after striking an obstacle to be drawn more in accordance with natural expectations and practical experience than that which is exemplified in Fig. 3.

Fig. 5 serves to illustrate the reasoning. As the vertical acceleration of the front portion of the vehicle must be produced during the very brief period while the axle B is being deflected from its horizontal course and turned around the point A where the impact takes place and cannot be continued after the point A of the wheelrim has ceased to be actuated, either the whole acceleration is communicated instantaneously or else the possibility exists that it, the acceleration, may be cut short the moment the impulse received becomes sufficiently strong to raise the wheel from contact with the obstacle before B has reached C. An instantaneous acceleration is out of the question, as it implies infinite forces. The inference is therefore that acceleration is received all the way from B to C, provided A remains in contact with the ridge. But it is observed that the tangent of curve BC at C is horizontal, so that, if axle B followed this curve, its upward course would here be finished; also, that any intermediate point of curve BC, such as F, represents a greater rise above the horizontal BD, considered in proportion to the corresponding horizontal progress BG of the vehicle, than the total rise at C to which the horizontal progress b corresponds. The vertical acceleration is therefore stronger nearer the moment of impact and results at one moment or another in raising B above the curve BC; that is, it results in raising A from the ridge, thereby cutting short further acceleration until gravitation takes the wheelrim back into contact with A. As this action operates on the principle of a governor, it is seen that in reality the theory of a violent vertical acceleration and a high leap as the result of an impact of an absolutely unelastic wheeled structure with an entirely unyielding ridge is inconsistent with itself, and that the wheel on the contrary must skim closely—in a series of infinitesimal bounds, it might be said—around the contours of the obstacle till its summit is passed, whereafter the trajectory to the road level depends upon its horizontal velocity. And a corrollary to this conclusion must be that where in practice an unsprung vehicle bounces considerably in passing over a hump or ridge, such action is due to whatever elasticity such a vehicle—or the ridge—possesses despite the absence of springs.

Retardation Not Negligible

It remains a fact that B is raised 3 inches in a certain time and that this time in the present case would be 0.01755 second if no retardation took place. With or without retardation, a force equal to such an acceleration of 1,000 pounds must have been abstracted from the kinetic energy of the vehicle, which is $1/2mv^2 = 1/2 \times \frac{3{,}000}{32} \times 50^2$. But as it has now been shown that the front axle cannot acquire the vertical velocity mentioned, the wheels on the contrary being compelled to hug the obstacle closely—if elastic elements are absolutely absent—it becomes necessary to conclude that the force of the im-

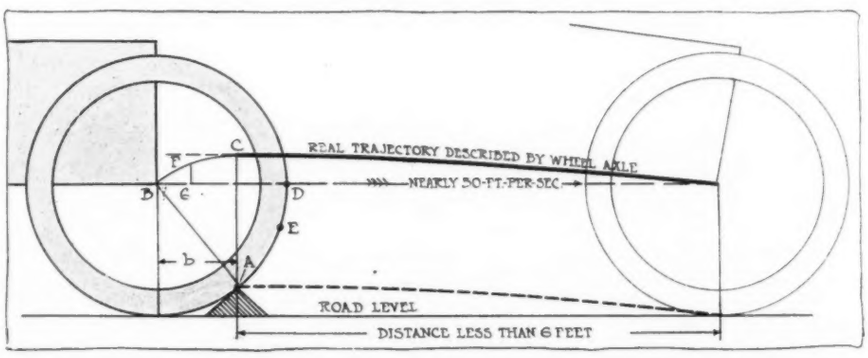


Fig. 5—Representing the movement really made by front wheel of vehicle without springs or elasticity, when it strikes a road obstacle at 35 miles per hour

pact must have been spent mostly in shock of the structure and, furthermore, that this shock means an actual and considerable retardation of the vehicle, resulting in just such a vertical component of the force as makes the wheel rise over the obstacle without surplus velocity for a leap.

The nature of the retardation, resulting, as it does, from converting the rectilinear movement of B into a circular movement for a very brief period is here a difficult element to bring in line with the laws of kinetic energy, whereof later.

As all ideas on the subject are associated with materials and structures having a more or less pronounced capacity for rebounding—in many cases coming into play only when the impact has great force—it is an effort to conceive the situation in the abstract and to realize that whether the front end of the vehicle is light or heavy, provided it is absolutely unresilient, the striking of an obstacle must retard the whole vehicle, which may be very heavy in proportion to the weight of its front portion, sufficiently to prevent this front portion from being thrown into the air more than just enough to clear the obstacle. Some experience with the driving of common unsprung farm wagons at a lively clip over rough ground helps the realization, however.

Transforming Shock Into Movement

It is also plain that if the unyielding obstacle is so shaped and so high as to resist the wheel at D, Fig. 5, it will stop the vehicle completely, and that the component of resistance which tends to arrest the vehicle simply gets gradually smaller below this point. There is thus always retardation. In fact the horizontal component of the force of impact is retardation, usually not so pronounced as to be felt as a shock, and the vertical component is the shock proper, which again is dissolved into destructive shock and motion, the motion being in the case of the unelastic vehicle only that of raising the vehicle over the obstruction and coming down to the road level again, and in all other cases only such additional movement as the constructive conditions permit. The mechanical object of spring suspension is therefore always to transform shock into movement by making movement possible, and to make the movement unobjectionable by extending it as much as possible in the direction of the travel. This becomes especially difficult when shocks are received in quick succession, as the shock forces then, in whatever manner they have been dissolved, accumulate upon a small amount of the forward movement of the vehicle in which they have to be absorbed—that is, which they have to be permitted to modify.

Load Distribution Secondary Without Springs

Somewhere between D and A, as at E, there is a point where the vertical component involved in the turning-movement of B around A as a center becomes so large that it must depend upon the relations between the mass of the whole vehicle and that of the front end whether the movement can be executed or the vehicle will be stopped, as a bumper consisting of curved-up rails stops a train of cars in a station yard. The relation of the masses—which is the same as the load distribution of the vehicle—thus enters into the question of the nature of the movements which will result, but, so far as unelastic vehicles are concerned, this is true only in case of large road obstructions, which have little to do with the main purposes of spring suspension. That the same factor, the distribution of masses, enters strongly the moment springs are used is another matter. On the other hand, speaking of the unelastic vehicle, as the force of an impact, other things equal, increases when a high obstacle is encountered and a relatively large vertical component is required for mounting the obstacle, there is apparently nothing to hinder acceptance of the inevitable conclusion that the force of the impact always automatically divides itself into one force causing a turning movement of B around A, just sufficient to clear the obstacle, and another force which is spent destructively in opposite directions from A and which retards the vehicle and the turning movement.

Perhaps an exception should be noted for the case that the ridge is slippery, so that A affords no reliable fulcrum for the turning movement, but consideration of what will happen in that case must here be deferred.

A Paradox Conclusion

The main theory, which could also be proved by applying the laws for the parallelogram of forces, seems to agree better than the one more commonly accepted with the practical results accomplished in the driving of unsprung vehicles—the shocks being much more objectionable in them than their movements over obstacles—and out of it there arises a certain general and preliminary view of spring suspensions, to the effect that the bounding of spring-suspended vehicles is wholly due to the use of springs while the shocks, if objectionable, are due to insufficient or wrong use of them, and that therefore any improvement looking to the reduction of both bouncing and shocks must consist in the limiting of spring action in some respects as well as to the extension or enlargement of it in other respects.

In motor vehicles the bouncing has, through speed, become as objectionable as the shocks, and the practical development has very properly taken up the work of providing for the limiting of the action as well as for extending the use and range of springs at the same time. But in theory the acceptance of this viewpoint has been less common.

An examination of the movements of a spring-suspended vehicle in passing over the 3-inch ridge of Fig. 3 should show, however, that the viewpoint has a practical value for steering further improvement into the best course. But first the retardations taking place with the unsprung vehicle may be briefly considered for comparison with the smaller retardations usually occurring with the use of spring suspensions.

(*To be continued*)

Narrowly Averted Famine in Tungsten Due to the War

At the outbreak of war a tungsten famine was threatened in England, and it looked as if it would be impossible for the Sheffield steel makers to supply not only the profitable export trade in high-speed steel but also their home market. Though Cornwall has considerable wolfram deposits, from which tungsten may be produced, and India and other British colonies have illimitable quantities of this raw material, it was found that somehow the method of producing the tungsten had been allowed to become a German monopoly. In the first days of alarm at the shortage, prices ran up to very fancy figures, but have since with the aid of some small imports from the United States dropped to about 5 shillings per pound, which is still twice as high as normally. Two British metallurgical concerns were at once started to provide metallic tungsten powder, and they promise to supply the market adequately in the spring of next year and forever after.

Molybdenum, which can take the place of tungsten in high-speed steels, though the latter is usually preferred, has also become very scarce. For a few years back the Krupps have been buying up this metal, as it is used in the making of big guns.

The first attempts at producing metallic tungsten powder, by the new British concerns, were not wholly successful, but all difficulties are said to have been overcome later.

Tungsten enters largely not only in high-speed steel but also in that used for magnetos, and to some extent in most steels of which extraordinary strength and anti-fatigue qualities are required.—From *The Engineer*, November 6.

Large Radiator Capacity Does Not Mean Efficiency

Ideal Radiator Is Unattainable—Aim Is Lightest Type That Will Do Greatest Amount of Work for Greatest Length of Time at Least Manufacturing Cost—Factors in Radiator Design

By Howard Greer, Jr.,
Chief Engineer, McCord Mfg. Co.

AN IDEAL RADIATOR IS NOT ATTAINABLE. OBVIOUSLY, THEREFORE, THE AIM SHOULD BE TO GET, AT LEAST COST, THE LIGHTEST RADIATOR THAT WOULD DO THE GREATEST AMOUNT OF WORK FOR THE GREATEST LENGTH OF TIME.

There are few if any parts of a car dependent upon so many factors as this one adjunct. It may not be out of place to mention some of the conditions which bear upon motor cooling:

Number of cylinders of motor; diameter of cylinders; length of stroke; speed of motor; whether motors are tight or free running; size and location of water-jackets in motor; dust guards on motor proper; efficiency of motor; efficiency of carbureter; sparking conditions; pump or thermo syphon; total quantity of water in system; quantity of water circulated; size of fan; location of fan; speed of fan; efficiency of fan; whether fan is housed; whether air has straight and free circulation under the hood; frontal area of radiator; efficiency of type of radiator; thickness of core; whether radiator is cased or integral tank; whether hood has louvres; relative size of water tubes and air passages; size, shape and location of air outlets under the hood; efficiency of radiator baffling; temperature of atmosphere; altitude where car is run; humidity of air; skill of operator; opinion of car builder as to amount of cooling necessary; road conditions; speed of car, and the weight of car.

Radiator Demands

Many of the foregoing items are indeterminable, except in specific cases. Therefore, the maxima have to be anticipated by giving the radiator capacity to meet their demands. But what these demands will be is largely a matter of opinion, as, for instance,

For how many minutes should a car run on low gear, under full motor load, at 10 miles an hour without boiling?

At 15 miles an hour without boiling?

At 20 miles an hour without boiling?

For how many minutes should a car run on second gear, under full motor load, at 10 miles an hour without boiling?

At 15 miles an hour without boiling?

At 20 miles an hour without boiling?

For how many minutes should a car run on high, under full motor load, at 10 miles an hour without boiling?

At 15 miles an hour without boiling?

At 20 miles an hour without boiling?

Editor's Note—Paper read by Howard Greer, Jr., Chief Engineer, McCord Mfg. Co., Detroit, Mich., before the S. A. E., Indianapolis, Ind., November 10, 1914.

Mathematics in Cooling

The answers to these questions vary as widely as do political opinions. To put these questions into concrete form: How many British thermal units must be absorbed to satisfactorily cool a given motor working through the full range of possible demands?

After that is decided, then it becomes necessary to consider the arrangement of the car whose motor is to be cooled, and how much of a radiator it will require to dissipate the determined amount of heat, and that means deciding on such points as:

What space is available for the radiator.

Quantity of water to be in the system.

Size and location of the waterways.

Rate at which the water is to be circulated.

Size, location and efficiency of fan and velocity of air through the radiator.

Whether air has sufficient outlet from the hood, and whether the passages are sufficient to allow an unobstructed flow of air through the radiator in its expanded condition.

It is often found that the air conditions are such that in a car speed up to 20 miles per hour the air goes in through part of the radiator and part of the same air comes out through another part of the radiator. The consequence is lack of uniform circulation of water.

Faulty Circulation

Often the bulk of the water circulating passes through a comparatively small section of the radiator core, while part of the water in the core stands still and part actually rises. This is due to irregular cooling, whether caused by the radiator or fan or conditions beyond them. These evils can all be due to causes outside of the radiator, though part of them may be due to improper or inadequate baffling in the radiator itself.

Fan Location

Fans should be so located and so arranged that they will draw air through every air passage of the radiator at the highest velocity commensurate with its cooling values; and to do this the fan must be rotated for its best efficiency. This is usually a rotation so high at low and medium speed of the motor that none of the ordinary pleasure car fans would hold together at motor speeds possible today if the fan belts did not slip.

Capacity Vs. Efficiency

Frequently radiator cooling efficiency is discussed when radiator cooling capacity is what is meant, for it is not uncommon to find a satisfactorily cooled car with a radiator of ample capacity but of abominable cooling efficiency. None the less, this very radiator may have great merit, because of its simplicity of construction, its freedom from clogging, its ruggedness of build and the fewness of its seams.

A radiator 24 by 24-inch, of the .25-

inch cellular type, has about 10,000 lineal inches of seams that must be watertight, while there are tubular types that have but 750 inches of seams that must be watertight. These latter, however, are frequently so inefficient, bulky and heavy that their adoption for pleasure cars is almost out of the question. Therefore, some lighter, efficient, though delicate cellular type is necessary, because of the restricted space available, even though such a radiator costs more and is less durable.

From this important angle, then, it is best to choose the radiator of proper capacity, which has the fewest possible number of places where leaks can occur, always keeping in mind which has the best type of joint.

Don'ts in Construction

Car designs, or demands for appearance, are so restrictive that ruggedness of construction within reasonable limits of cost is today almost impossible.

For structural reasons the following should be avoided:

1—*Shafts should not go through the bottom tank.*

2—*No wrought iron or steel of any kind should be used in a radiator where it comes in contact with water, because of the excessive rusting.*

3—*Crooked inlets and outlets should be avoided. They are expensive to make, difficult to apply and frequently it is impossible to attach them with as many rivets as necessary.*

4—*Long inlets and outlets are objectionable, because if they are strained at all the leverage on rather a weak radiator tank is so great as to probably injure the joint.*

5—*Inlets and outlets or their flanges should always be kept as far away from the edges or seams of the tank as possible, else in soldering the inlet the seam be loosened, or in soldering the seam the inlet be loosened.*

6—*It is always well to have a top tank of not less than 3 inches in depth, so as far as possible to insure always having enough water to cover the top of the tubes. If the radiator is to be used for thermo-syphon circulation the top tank ought not to be less than 4½ inches deep, so as to get a head of water over the tubes and of the extended tank type so as to have sufficient water in the radiator to insure as far as possible always having the tubes covered with an ample head.*

7—*Extended tanks which overhang more than 3½ inches are objectionable, because of the difficulty of supporting them in their overhung position.*

8—*Shallow bottom tanks are objectionable, primarily because they do not, as a rule, present enough surface to which to properly apply the outlet casting.*

9—*Radiator holding down studs should be on the center line of the center of gravity of the radiator when it is in its working position and of such a distance apart that if the lower tank deflects at all the deflection will be no greater between the studs than beyond them and vice versa.*

10—*Often for the sake of design the frontal shape of the radiator is such as to necessitate the use of side tanks in the top corners, and in some instances also side tanks in the bottom corners. Such an arrangement increases the number of joints in the radiator and introduces the tubes into the tanks at such an acute angle that making and maintaining them tight is very difficult.*

11—*Where possible it is best not to have a hood ledge offset greater than 1-8 inch, because of the difficulty of getting material for casings that will stand greater offset.*

12—*Core face offset of the radiator casing had best be never over 1-4 inch deep, on account of the difficulty of drawing such frames.*

13—*When a casing is made with too much taper great difficulty is encountered in the drawing, and the expense of the drawing tools runs up enormously. Frequently many thousands of dollars on radiator casing tools could be saved if a few comparatively insignificant angles and tapers could be brought within mechanical limits.*

Rivets, Then Solder

All castings that are to be soldered to a radiator should be held in place by rivets and applied to the flat face of the sheet where possible, always avoiding going around the corners.

To properly solder two metals, they must both be of such a heat as to bring the solder to its greatest fluidity and, obviously, any parts that are not in such contact as to prevent the solder running through their joints are not properly fitted. A radiator should be so mechanically constructed that it will hold together without any solder, and thus leave the solder to perform the function of a gasket.

Solder is a weak soft metal that crystallizes readily under vibration, but makes an excellent gasket if it is not strained in holding parts together.

Mounting the Radiator

The failure of radiator joints is by no means an indication of poor workmanship or improper design. Often the member employed to support the radiator is inadequate, and sometimes troubles from poor supporting are augmented by unnecessary hood strains through the kind of latches used or strains brought about by the inlet and outlet being connected to the motor, while the radiator itself is mounted upon the frame of the car.

To properly mount a radiator a suitable support or suspension for the particular design must be provided or else the proper design of radiator for the supports available must be selected. If a radiator is to have stud mounting, its bottom tank reinforcement should rest upon soft pads which will retain their elasticity, and these pads should never be over 2 1-2 inches by 2 1-2 inches and should come between the tank and the supporting member on the car. This member must deflect a minimum and twist the car frame rather than be twisted by it if you want to save the radiator.

If the car design requires a trunnion or bracket support attached directly to the frame channels, it is advisable, if not essential, to have the road strains come upon a separate casing into which the radiator proper is bolted, so as to save it from the direct road shocks.

Enamelling Problems

As cars have become lighter and more flexible, more demands have been put upon the radiator, and as in America where the blue black body colors have become popular, it is necessary to match them with the radiator, and to do this and have the finish last it is necessary to enamel by baking. To enamel satisfactorily, without injury to the soldered joints, a detachable casing which may be baked at a temperature which would injure soldered joints is desirable.

Since there are so many limitations imposed upon the radiator manufacturer by materials, tools and the ability and class of labor to be had, it would doubtless be of mutual benefit to both the manufacturer and the car builder if they would, in every instance before a radiator is needed, get together for mutual assistance and exchange of views.

Radiator Suits Car

Every car should be fitted with a radiator particularly designed to meet the cooling conditions encountered, and should be constructed in such way as to meet, as fully as possible, the strains which may be brought upon it through its particular method of support.

Materials for Radiators

In the selection of materials for radiator construction great care must always be exercised to insure their being proper for the work required. Brass must be free from defects and of proper hardness or softness, dependent upon the purpose for which it is to be used. The percentage of tin in the solder must be different for the different kinds of work the solder is to do, and the castings, particularly those that are to be watertight, must be made and tinned with the greatest possible care to insure their not rusting out and that they will always be tight.

The internal baffling in a radiator is of great importance, particularly be-

cause the water almost invariably enters the center of the top tank and goes out of but one corner of the bottom tank. If the baffling is not such as to insure the proper distribution of the water in the top tank so that it will go down uniformly through the radiator, in spite of the fact that it is taken out irregularly at one end of the bottom tank, then the baffling is not correct.

Locating Baffles

And if it happens that the fan to be used in conjunction with the particular radiator takes its air through the core in such way as to cool it more in one section than in the other, then the baffling should be arranged so as to pass through this section of the core a proper amount of water to insure obtaining the highest total efficiency from the apparatus.

The radiator cap has been a subject of much discussion and great variety of design, and today it has reached the point where practically all caps have their threads on the inside, so as to save them from abrasion if they are dropped, and this puts the thread in the filler tube on the outside to save it from abrasion from funnels, etc., used in filling the radiator.

The finish of the cap varies from the condition left by the sand in the mold, through polishing and plating, up to coatings of hard rubber or Bakelite, which latter is a synthetic rubber made from carbolic acid and formaldehyde, and a pigment to give it color, and an asbestos or wood fiber filler to give it body. It has many characteristics which make it more valuable for the purpose than hard rubber. Its cost is about the same as gutta percha. It is somewhat stronger, though a little less elastic; will withstand all the heat that can ever be brought upon it in a radiator cap. It takes a high polish, and has the merit of not bleaching out.

Protect Filler Screen

An important part of a radiator is its filler screen, and yet it is frequently not used, or if it is left in the filler tube, it has a hole punched by a funnel, which makes it ineffective. If users could be made to realize the importance of straining the water that goes into the radiator, they certainly would take much better care of the screens.

In the city of Detroit a radiator, presumably using nothing but city water, was so clogged in 6 months, that in a thermal test it showed a dissipation of only about 720 B.t.u.'s; but after its core was removed and thoroughly cleaned, and the radiator rebuilt, the same radiator in its clean condition dissipated 1100 B.t.u.'s.

The overflow tube which is usually looked upon as an unimportant adjunct, not infrequently is the cause of much annoyance, for should a slight leak occur where this tube enters the tank, the water will flow down the tube on the outside, giving all the appearance of taking care of an overflow from an overfull tank; while as a matter of fact, the tank may be nearly empty.

On the other hand, very frequently a radiator which is far from full, but is improperly baffled, swirls its water in its top tank, so that a large portion of it is lost down the overflow, unless the overflow tube is closed at the top and the vent hole into it put on the side up against the inside of the filler tube.

Water Surging

Even though a top tank be properly baffled, for the distribution of the water, it is not at all certain that it is properly baffled to prevent surging, which almost invariably occurs when a car is started or stopped suddenly. In one instance a car was driven over country roads at an average speed of 26 miles an hour for 1 hour and 10 minutes, and lost no appreciable amount of water, either through evaporation or lost down the overflow tube. But 3 pints of water were lost in the next 30 minutes by the same car, which was driven through a highly congested district of a large city, where the stopping and starting was very frequent, for every time this car started and stopped, the water swashed, and some ran out at the overflow.

Testing Radiators

Testing apparatus for determining the relative efficiency and capacity of radiators is comparatively inexpensive and easily had, and invaluable to both the car builder and the radiator manufacturer. The best type of apparatus consists of some kind of water heater with thermostatic control, a pump and a meter to measure the quantity of water circulated; scales to weigh the total quantity of water in the system; thermometers to take the temperature of the inlet and outlet air, and the inlet and outlet water; variable speed motors which can be set at a wide range of speed for both pump and fan; humidor to maintain a standard humidity in the testing room; airometer for taking the velocity of the air through the radiator, and tachometer by which to register the variation in the speeds of the motors due to change of voltage of current. And by thermal calculations it is not difficult to tell the number of B.t.u.'s dissipated in a given time by a given radiator under conditions held practically constant and standard.

In testing radiators for capacity, it is necessary to compare them with some known standard. Such a standard can be easily established by taking a car which acceptably cools for every one, and running it with a given load, a given distance up a certain hill on its different gears,—first at 5 miles, then 10 miles, then 15 miles, then 20 miles per hour, starting each time at the bottom with the water in the system about 120 degrees, and noting the rise in temperature when the car finishes its run, which run should not be less than a mile.

By making this series of runs on various gears and at various speeds, it is possible to establish a standard by which to compare other cars' performances.

Glass Radiators

Observing circulating water carrying fine sawdust in a glass radiator, a number of interesting phenomena appear which are valuable guides in pointing the way to proper baffling and proper fan location, for to get the best capacity out of the radiator, it is necessary to have a suitable proportion of the water passing through the zones of the radiator, through which a given quantity of air travels. And if these proportions are not obtained, and there is either an excess of air, or such an excess of water that the proper amount of heat is not absorbed, the circulation is immediately affected.

There have been radiators constructed in which the water was made to circulate through horizontal passages a number of times across the face of the core. These have the objection of being difficult and expensive to construct, and more or less difficult to drain. There have also been radiators constructed in which all the water went through a series of passages on the back of the radiator, and up through a series of passages in the middle of the core, and down through a series of passages at the front of the core. Such a radiator has a cooling advantage over the straight-flow type, showing, in some instances, more than 8 per cent. increased capacity.

The larger the quantity of water is in a cooling system, the more uniform can the temperature of that system be kept. Quantity is particularly advantageous in hill-climbing, on the principle that it takes longer to boil a big teakettle than it does to boil a small one.

Thermostatic Control

From a purely theoretical standpoint, thermosyphon system of cooling is best, but in actual practice such a system, restricted in its application as it must be on a motor car, does not fulfil expectations on account of the wide range of demand put upon it. The time is probably not far distant when cars will be equipped with some type of thermostatic control in their cooling system, so as to maintain the water in the motor jackets at as nearly a constant temperature as possible, irrespective of the work the motor is doing. And it is not beyond reasonable expectation to anticipate the introduction of an effective and cheap fan regulator which will assist in this thermostatic control, by furnishing the proper proportion of air to cool the water to the required degree.

A Testing Plant for Spark Plugs

Toledo Firm Has Experimental Department for Improving Manufacturing Methods, Etc.

UP in an isolated part of the top floor of the big plant of the Champion Spark Plug Co., Toledo, O., where 25,000 spark plugs are born each day, they have an experimental and testing department which would do credit to a motor manufacturer, to say nothing of a concern which does nothing but make the small, but essential, spark plugs that cause the firing of the charges in an engine.

To the average automobilist, a spark plug is simply a little device which brings two terminals of an electric circuit close together so that a spark can jump from one to the other and thus ignite a compressed charge of gas. But to the speclalist in this line it means more. He knows it to be a highly perfected article which he is constantly trying to improve by testing and experimentation.

A spark plug is subject to a number of maladies. It may be given to prematurely igniting the charges; it may be so constructed that there is not the hot spark necessary to greatest power; it may develop leakage under compression and heating.

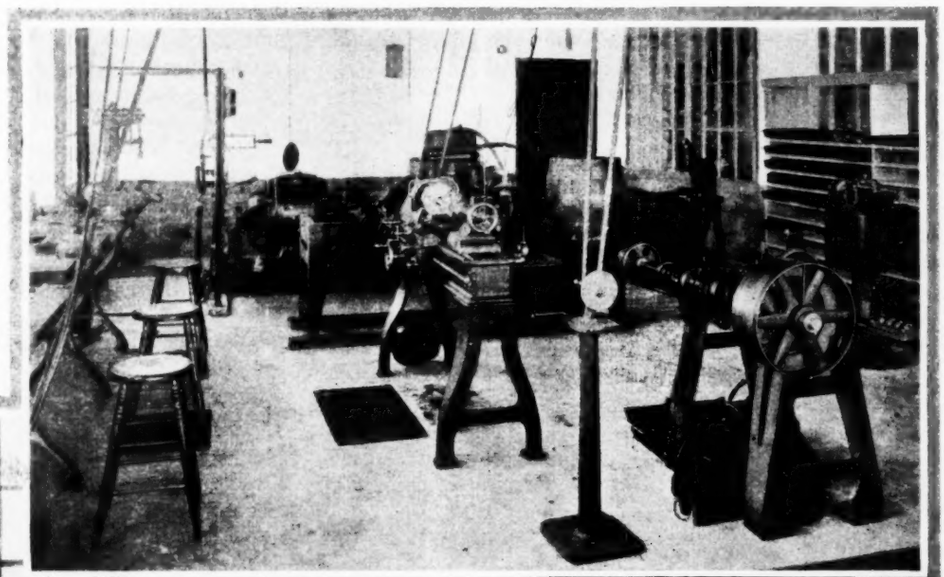
It is primarily for studying the effects of various factors entering into the ignition problem and for purposes of comparing the power output of a motor equipped with its plugs and with other makers' plugs that Champion has installed this new department which is in reality a miniature machine shop and testing room.

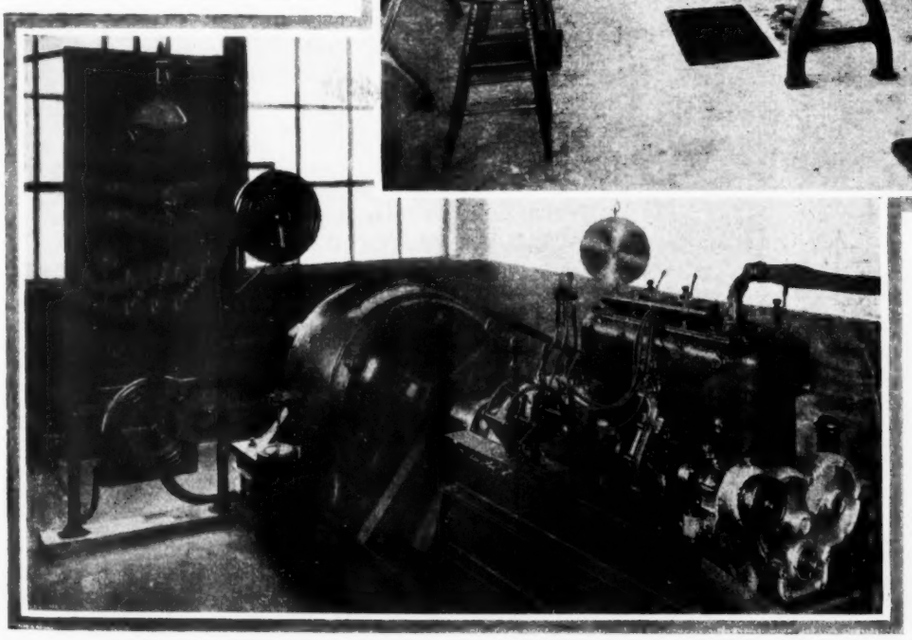
There is a complete electric dynamometer set with a capacity of 70 horsepower which is driven by a gasoline engine tuned up so as to run as high as 2,000 revolutions per minute. The factory simply regards this engine and equipment as apparatus to try its plugs out on. The generator is a Sprague, rated at 42 1-2 k. w. at 1,800 revolutions per minute. It operates with 250 volts and the amperage is 170. In addition to this apparatus there is a separate gasoline motor used only for idling tests, to say nothing of the lathes and other machine tools.

This experimental department is constantly at work on the development of new machinery to lessen the labor cost throughout the plant. For instance, at this time it is working on an automatic electric welder which will do away with the present method of welding by hand. When perfected, this complicated machine will automatically feed the spindles and wires to be joined to make the center electrodes of a plug, the sparking point being platinum and the main wire steel.

If any new type of plug is developed, it falls to the lot of this recently established section of the Champion works to devise the best and cheapest method of making it. Consequently it is made in this department in all the possible ways, and the best of them decided upon as the method to recommend to the manufacturing departments.

Every so often a batch of the regular run of plugs is taken at random from the product coming through the factory, and these sent up to the testing department. Here they are first put on the gasoline engine, with its electric dynamometer for load, and tested for all conditions of running. Then they are set in the idling motor and run some more, this idling test being the hardest to which the plug can be subjected.

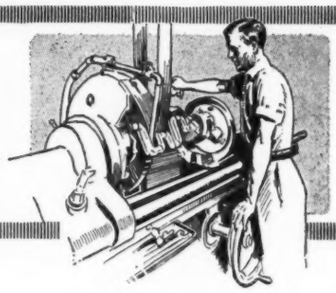




Above—A corner of the testing and experimental room of a concern making only one thing—spark plugs. In this department are all machines necessary to development of new machinery; to the production of a spark plug, etc. Here any new plug is first made and best methods of manufacture worked out before it is turned over to the manufacturing department for production in quantity

Left—A complete electric dynamometer testing outfit used only in testing spark plugs. The gasoline engine is capable of 70 horsepower and is tuned to run as high as 2000 r.p.m. Thus almost any motor operative conditions are obtainable and plugs can be observed when firing the motor under any of these conditions

The Rostrum



This department is for the instruction of the readers and all are at liberty to ask questions. Be sure to give full name and address that we may send you a reply by letter if there is no space in the Rostrum. If you wish to sign a fictitious name, also sign your own.

Claims Cyclecar Is Still the Future Means of Transportation

EDITOR THE AUTOMOBILE:—Before the ashes are sifted over the grave of the sporadic cyclecar movement of 1914 (as is being suggested in some quarters), a few words might be of interest from one who has studied these sporadic cyclecars, ridden in several, nursed the troubles of one of the most troublesome, and still believes more strongly than ever that the pure cyclecars developed within the past year are nearer to the future means of light transportation than any other type yet constructed. The cyclecar here referred to is the vehicle defined by the original limits of 71 cubic inches displacement and 750 pounds weight, with the usual principles of two air-cooled cylinders, friction or planetary transmission, belt or chain drive, light rear axle, narrow tread and tandem seating.

The motor-buying public is now in a different frame of mind than when the automobile and motorcycle came out. The motor vehicle of the present day is no longer a toy to be taken out to see how far it will run; it is a means of getting somewhere. If the early automobiles had been judged by this standard, they would have died much sooner than the cyclecars have. But they were given time to develop, and the successes of the present are built on the failures of the past. This does not prove that cyclecars should be made and bought whether they are reliable or not, but it suggests that they may not yet be permanently dead just because many of those hitherto built have been far from trouble-proof.

A few of the facts and accomplishments of the cyclecar may be enumerated, lest we forget: They have been driven at speeds higher than practicable in any but the highest-priced automobiles, over rough and rutty roads, with extraordinary comfort to the occupants, at a fuel economy of over 40 miles per gallon (my own experience without any special adjustments or economizers), and a tire economy and reliability represented by a weight of less than 250 pounds per tire, in a car requiring much less attention in normal use (lubrication, tire work, etc.) than the ordinary automobile.

There has been a noticeable absence of dangerous accidents, in spite of the flimsy construction employed on many of them. Cyclecars do not turn turtle.

If it is claimed that flimsy construction is a necessary companion of light weight, we have but to refer to the motorcycles, which, laden down with heavy equipment, so strong that they can carry up to six passengers, weigh less than half the standard cyclecar figure of 750 pounds. In fact, there are few of the objections advanced against the cyclecar which do not apply with equal force to the motorcycle.

The cyclecar has been regarded as an automobile made up of freak parts, when it is really constructed of parts already absolutely standardized, partly in automobiles, and partly in motorcycles. I do not know of a principle or device used to any extent on the cyclecars of the past year which has not a long and honorable record in either the two- or four-wheeled field, with the possible exception of two which are by no means representative.

Why then have the cykes been brought into disrepute? Not because air-cooled V-engines are bad—they are still standard on motorcycles. Not because friction transmissions are bad—they won the 1913 Glidden tour. Not because the narrow tread is bad—such statements are made only by those who have never tested it. Simply because the correct combination of these features requires better engineering than has been put into it in most cases. Because the field has been invaded by get-rich-quick parties, and the movement fought by both the motorcycle and automobile interests, and because if any company has yet invested the necessary large capital in the right way to bring out a real cyclecar, it has not yet reached the publicity stage.

Tandem seating is perhaps the hardest pill for the average motorist to swallow. It is not a necessary cyclecar feature, but it will be better liked with an increased appreciation of low centers of gravity, center drive, and the handiness of the narrow tread in traffic.

The writer believes on the whole that the supposed objections to the cyclecar type are not fundamental, and would like to read expressions of others on this question.

H. KURTZ RANDALL, M.E.

Best Position for Spark

Editor THE AUTOMOBILE:—1—In four-cycle internal combustion motors is there an exact relative time at which the spark should occur to produce the highest efficiency of the

motor? In other words, what is the correct relation in degrees of spark advance or retard to the speed of the motor?

2—Should the advance or retard of the spark be in absolute (predetermined) synchronism with the motor throughout its entire range of speed?

3—Which will give the best results for general road driving, an automatically controlled or a manually controlled spark, and why?

4—In an electrically equipped car, is there any logical reason for having two electric generators? One supplying current to the storage battery for lighting and operating the cranking motor; the other for generating current for the ignition system?

5—Under all conditions is a magneto spark as efficient as a spark obtained from a storage battery?

6—For general touring purposes in a mountainous country over all kinds of roads, which is the more efficient and economical: A small-bore, long-stroke, high-speed motor, or a larger-bore, shorter-stroke, slower-speed motor, both having the same relative horsepower and operating under the same load conditions? What, if any, advantages has the one over the other?

Bloomsburg, Pa. C. S. VAN HORN, D.D.S.

—1—Yes, there is a time when the spark is most effective but it is impossible to state this in degrees because it depends on the size and shape of the combustion chamber, the speed of the motor, the mixture, the compression, the location of the spark plug and the intensity of the spark.

2—No. The advance should vary roughly according to the speed. At low speeds the spark should be retarded and at high speeds it should be advanced. In any case less advance is required as the throttle is opened because the speed of combustion increases with the working compression which depends directly on the amount of throttle opening.

The necessity for advancing the spark is brought about by the fact that it takes a definite time to produce the spark, that is, from the instant the breaker points separate on the magneto until the spark occurs in the cylinder a small amount of time is consumed, this interval being the same whether the motor is running fast or slow. Therefore, if the magneto is set to give a spark just on dead center when the motor is running 300 revolutions per minute then the spark will occur too late when the motor is operating at 2,500, for the speed of the motor has increased eight times yet the interval in which the spark is produced has not been reduced at all. It is to compensate for this lag that the spark must be advanced as the motor speed increases.

3—This is an unsettled question. For the automatic spark control it is argued that the average driver is not sufficiently skilful to set the spark lever in the place for best efficiency under different conditions of driving and that therefore the set spark is superior.

Those in favor of the manual control generally admit that the automatic control is preferable for the unskilful driver but for the experienced motorist better results can be obtained from the hand control.

4—Some makers believe it better to have the ignition system independent because there is a greater safety factor.

5—See THE AUTOMOBILE for December 3, page 1020.

6—The advantage of the small-bore, high-speed motor is that it is more economical and lighter, on the other hand it must be somewhat noisier perhaps the noise is not appreciably greater, and it may not stand up as well although this is largely a matter of design.

Two-Story Garage Design

Editor THE AUTOMOBILE:—Kindly give me a layout for a two-story garage, 60 by 100 with elevator.

Little Falls, N. Y. C. F. Ross.

—The plan of your garage should largely be determined by what you desire to use it for, and although you are not an architect, you, probably better than anyone else, can select the best plan. First of all decide just what you desire to use it for. Are you going to have a supply store in connection with it, and will you need a salesroom for cars? Will your repair trade be heavy? When you have all the facts governing the design of this building before you, you can easily make a plan that will be found suitable and convenient.

Fig. 1 shows a plan that will be found good. In this design it is assumed that you are to run a supply store but not a salesroom. The office and store are put at the front of the building along the street. Directly back of them is the stairs which may be reached conveniently from the office or the main floor of the garage. In the other corner at the front is the elevator, which may be entered from the street as well as from the main floor of the garage. The elevator should be made large enough to take the largest pleasure car comfortably but need not have capacity enough for trucks as any of these you may have may be stored on the ground floor.

At the rear of the main floor, extending all across the back is the repair shop. The machine tools are grouped at one side, and the forge is placed against the wall. There is a bench along the back wall where the light is good and the rest of the space is for accommodating the cars that are being repaired.

Ignition Current Negligible

Editor THE AUTOMOBILE:—1—When using a six-cylinder automobile engine of 2.5 bore by 5 stroke, with two 15-candlepower, 7-volt headlights switched on full, one tail light and one dash light, each 4 candlepower and 3.5-volt, what proportion of the total current being drawn from storage battery is consumed for ignition of the engine.

2—Is the amount of current consumed for ignition constant or do different engine speeds or different road conditions cause it to vary?

3—What is the approximate saving in current when using the two headlights switched on as dimmers instead of switched on full?

4—Which furnishes the hotter spark at slow engine speeds—a storage battery or a high-tension magneto, assuming both are working efficiently?

New Orleans, La. D. WILLIAMS.

—1—The proportion of current is negligible.

According to some data given on page 1021 of THE AUTOMOBILE for December 3 the average battery spark has an ampere flow which reaches a maximum of .04. The shape of the wave is triangular, therefore the average flow is one-half this or .02. The time is .006 seconds. Assuming that the motor is running 1,000 revolutions per minute, 1,500 sparks are generated. Therefore the average current flow during 1 minute is $1{,}500 \times .02 \times .006 \div 60 = .003$ ampere.

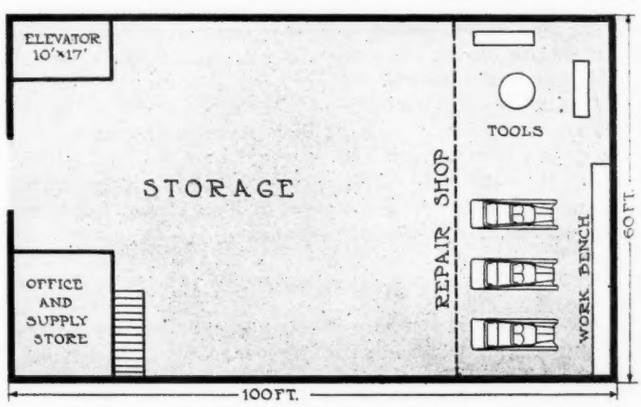


Fig. 1—Plan of ground floor of public garage 60 by 100 feet

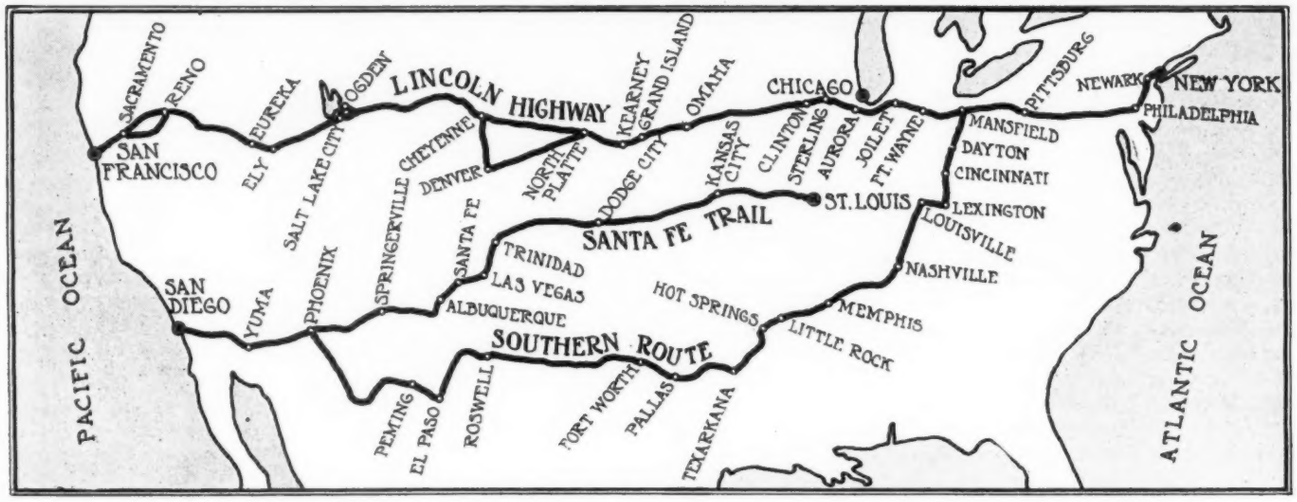


Fig. 2—Three routes to the Pacific Coast: The Lincoln Highway, The Santa Fé Trail and the Borderland or Southern Route

2—The consumption of current is proportional to the motor speed—for instance, at 600 revolutions twice as many sparks are required as at 300. However, no more current is required to produce a single spark at 600 or 3,000 for that matter than is required at 300.

3—This all depends on the method of dimming used. If the lamps are dimmed by connecting them in series, then the current consumption is cut in half if the resistance in the wires is neglected, and since this is small it may be. If two bulbs are used in the headlight, a large one in focus for country driving and a small one out of focus for city driving, the saving may be much greater, the small bulb taking about one-fourth the current of the large one.

4—Under favorable conditions there should be little difference.

Heavy Car Requires Large Motor

Editor THE AUTOMOBILE:—I am considering installing a new power plant in my seven-passenger car, 128-inch wheelbase, weighing 3,450 pounds and with gears adapted to 45 horsepower. What size motor would you advise for all-around service especially where roads are sandy and hilly, generally rough going?

Would the economy of say a 4.25 by 5.25 be offset by more lower gear running or would a 5 by 6 even with greater gas consumption give more general satisfaction?

Springfield, Mass. W. B. S.

—A motor measuring 5 by 6 would give an excellent performance and would certainly be advisable unless the increased gasoline consumption is objectionable. If you adopt this motor be sure that it is not too powerful for the transmitting mechanism because if it is it may cause undue wear or breakage. Again, there may not be room to place a motor of this size in the chassis.

The 4.25 by 5.25 motor would be rather small although there are many cars of this size using a motor no larger.

Possibly the most satisfactory would be a 4.5 by 5.5-inch motor. It would not unduly strain the parts, its gasoline consumption would not be too great and yet it would develop power enough to satisfy most motorists.

Fire Comes from Cut-Out

Editor THE AUTOMOBILE:—Please advise me regarding the following: I am troubled with fire coming from the exhaust cut-out underneath my car when running rapidly and shutting off quickly. Also when pulling hard. It is not the regular exhaust from the engine, but a large blaze like gasoline fire which comes clear to the ground and spreads out several feet each way.

I am at a loss to know whether or not I am using too much gasoline or whether the valves are not seating properly, or whether too much lubricant, which comes through and catches fire?

Petersburg, Ill. I. R. ABBOTT.

—It is difficult to say exactly what is causing this trouble without seeing the car. However, it may be that the valves are improperly timed or the mixture may not be correct. If the valves have been reset lately it would be wise to make certain that the timing is correct, but if they have not been reset, they probably are all right.

If the mixture is at fault it is a simple matter to adjust the carbureter.

Possibly there is carbon in the exhaust pipe or it may be that you are running with the spark too late.

How to Mix Graphite with Oil

Editor THE AUTOMOBILE:—1—We have a 1912 car that has a unit power plant using one grade of oil for crankcase multiple disk clutch and gearset. The oiling system is circulating splash with pump, and we understand that some car owners put graphite with the cylinder oil for better lubrication. Can we use graphite in our power plant? If so, how much graphite to the gallon of cylinder oil and what make of graphite is the best?

2—Will graphite make the clutch slip and is the use of graphite in the power plant good practice?

Rockland, Me. E. O. P.

—1—Us one teaspoonful of flake graphite to each quart of oil. Do not throw the graphite in loose, but mix it into a soft paste first and then add it to the oil. In buying the graphite be careful to obtain a good motor graphite as some graphites are not suited for motor lubrication. Some are too coarse, others too fine and some contain grit. Therefore, be certain you obtain a good motor graphite.

2—The graphite will not make the clutch slip. It is generally considered that the use of flake graphite will improve lubrication by cutting down friction and reducing wear.

Abbott Gearing 3.5 to 1

Editor THE AUTOMOBILE:—1—Please tell me the gearing when on direct drive of our 1913 Abbott, seven-passenger touring car, model E 44-50. We use 37 by 5-inch tires.

2—What is the maximum speed?

3—Which is the more nearly correct horsepower rating; the S. A. E. or the A. L. A. M.?

4—Our motor has a bore of 4.5 and a stroke of 5.5 inches. What is the S. A. E. and the A. L. A. M. rating of it?

5—When either of the axle shafts are removed from the rear wheels the wheel can be wabbled around on the bearing. Schaffer annular ball bearings are in the wheels. Please explain why this happens?

New York. LAWRENCE A. DIETZ.

—1—The gear ratio is 3.5 to 1. The size of the tires has nothing to do with the gear ratio. The gear ratio is the ratio between the size of the bevel pinion and crown gear in the rear axle. The size of the tires has an influence on the maximum speed that may be obtained but it is not connected in any way with the gear ratio. If bicycle practice were followed we might obtain a figure representing the total gearing by multiplying the size of the tire by the gear ratio, but this is never done.

2—The maximum speed is between 50 and 55 miles per hour.

3—These two ratings are identical. When the A. L. A. M. went out of existence several years ago, the name S. A. E. was gradually given to the rating as this method of figuring horsepower was recognized by the Society of Automobile Engineers. The A. L. A. M. formula was imported from Great Britain where it is known as the R. A. C. or Royal Automobile Club formula.

The formula in question is, horsepower $= \frac{D^2N}{2.5}$, where

D = bore in inches and N = number of cylinders.

3—Answered above.

4—The S. A. E. rating is 32.4.

5—This is as it should be. A certain amount of play is allowed when the shafts are removed. As long as the shafts are tight there should be no play, however.

Three Routes Offered to Pacific Coast Tourists

Editor THE AUTOMOBILE:—I am figuring on touring out to the Panama Pacific Exposition next summer and one of the things which will determine whether or not I make this trip is the length of time involved. I would, therefore, be glad if you could inform me on this point and perhaps map out a route. Some of the readers who have made extensive tours might be able to offer information in regard to the eastern conditions and also the much more valuable suggestions relating to the equipment of a car. I would like to hear from readers on this latter point as many others who are going and expect to make their car their hotel, might be able to obtain valuable information through your columns.

Cleveland, O. READER.

—You might make the trip in 1 month although this would be traveling fast.

Details concerning the different transcontinental routes and other information regarding the trip are given below, the material being taken from the Automobile Blue Book.

Only conditions west of the Mississippi River will be taken up. In point of road conditions, accommodations and supplies this article might be restricted to the territory west of Kansas and Nebraska, for under ordinary touring conditions met with in the summer there is probably no section where better time can be made than on any of the well-known routes across Iowa, Missouri, Nebraska and Kansas. Although the distances between towns are a little greater than on most of the routes east of the Mississippi River, plenty of accommodations and garages will be found along these routes to answer the needs of the most exacting motorists. The only precaution at all necessary is that in western Kansas and Nebraska during midsummer it is advisable to carry a full African water bag at all times simply for the comfort of the tourists.

Just as soon as the motorist goes west from Cheyenne or Denver it is advisable to make a few other additions in equipment and supplies. If there are four in the party at least two water bags should be carried, as some cars will need an extra supply of water for radiator in climbing to higher altitudes or in hard pulls through sand. It is always well to be prepared. Also some food supply should be carried at all times, with a blanket for each one in the party; another thing, warm clothing should be provided, for with the sun below the horizon the temperature drops very fast in high altitudes, and the nights are surprisingly cool even in the summer time.

If everything goes all right, as it does with the majority of tourists, the trip will be comparatively easy, but if breakdowns or stops due to lack of gasoline occur, as they sometimes do out in the barren places, then serious results are sure to happen unless there is another car in the party to go back for supplies, which may be thirty, forty or fifty miles distant. Such long stretches with hardly a habitation occur on any transcontinental route in some part or other, but even these are no drawbacks in themselves to the trip if, as stated above, proper precautions are taken not only in supplies and equipment, but that the tourist drive in accordance with local conditions.

Going west from Cheyenne along the Lincoln Highway little difficulty will be found in crossing the Continental Divide, for the rise is gradual, and many people will not know when they are crossing the backbone of the continent. For the most part southern Wyoming offers a very good natural road material of a gravelly dirt in sufficient quantities to surface the whole road. This is being done rapidly; moreover, the fords and dry washes are being bridged, especially those that may have given difficulty a year or two ago. West of Salt Lake City or Ogden there is a choice of two routes. There is a short line along the route of the Lincoln Highway to Ely, but this presents two difficulties. First, this route, although shorter than the northern one, crosses one of the most barren parts of the Great American Desert, and soon after leaving Salt Lake City practically no habitation of any kind is encountered for over eighty miles, but for present conditions the northern route around Great Salt Lake is to be preferred, as it follows for the most part the line of the railroad, accommodations are more frequent, and as a whole road conditions are better. Both of these routes join at Eureka and continue west, with generally good going into California. Natural road conditions in Nevada are excellent, and soon after entering California modern improved roads are followed to the Coast.

Where the Scenery Is

The above route, which for the most part is along the line of the Lincoln Highway, will probably receive the greatest amount of travel, but to those desiring to get the full benefit of a trip in the West little opportunity is given of seeing Rocky Mountain scenery. To those who have a little more time and like magnificent scenery, the trip across Colorado offers wonderful possibilities. The most serious drawback to this route is not the road conditions in Colorado, but the conditions after the Colorado line is crossed, and from there most of the way into Salt Lake City. The desert must be crossed for nearly two hundred miles. Those who by experience and equipment are prepared for such a trip will find the scenery of Colorado well worth the slightly increased hardships of crossing Utah.

To those desiring to follow the more southern route there are two optionals presented, the best known being the Old Santa Fe Trail, which continues westward along the route of the Ocean-to-Ocean Highway across New Mexico and Arizona. Here again the Continental Divide is crossed so easily that the stranger would have to be told the exact point of highest altitude. The route for the most part, especially across New Mexico, has received a great deal of improvement, and accommodations and supplies are of just about the right interval for each day's run. In Arizona one or two sections are still in need of improvement, but this is going forward rapidly and really no serious difficulties will be had on the trip as far west as Phœnix. From there on greater caution should be used in both equipment and driving, although as far as Yuma quite frequent accommodations and supplies are to be had. The short stretch between Yuma and El Centro is the most difficult part of the southern route, and really no permanent location has been determined for this link at present.

The other route spoken of as a southern link for transcontinental travel is one of the latest developments, known as the Borderland Route, which leaves the Old Santa Fe Trail in western Kansas, going through the Panhandle of Texas and crossing southern New Mexico and Arizona. Due to the mining industry the southern portions of these two latter states is being developed very rapidly with corresponding road improvement.

June the Best Time

If going by the central routes, about the only practical time is between May and the latter part of September, and even then if it happens to be a late spring with heavy rains conditions may not be favorable, and it is really best not to leave until after the middle of June, taking the trip as a whole. There is also a possibility of early storms in high altitudes even in September, although many years the routes are open clear to late October. On the southern route, if not starting too late so as to get west of Kansas and Nebraska before the fall rains set in, the route across Arizona and New Mexico can be traveled almost any month in the year, probably the best time being in September, October and November. The spring is also good, as the rainy season there is in July and August. The objection to the summer months is not so much on account of rain, which is quickly over in that part of the country, but on account of the exceedingly warm days.

In tire equipment it is advisable to have practically new tires all around, and two extra casings with about four tubes. Take a few small repair parts that you have found from experience to be of most use on your particular car. Above all do not try to take along enough to rebuild the whole car. Remember that extra weight is the worst possible thing you can carry. This brings us to the all important point of **keeping the load light.** Remember that, no matter how large or powerful the car it is just as bad to have it overloaded as it is a light car.

There are only a few sections where an extra provision is at all necessary in the way of gasoline, although some people find it advisable to provide an extra tank. Usually one or two 5-gallon cans are sufficient for any emergency.

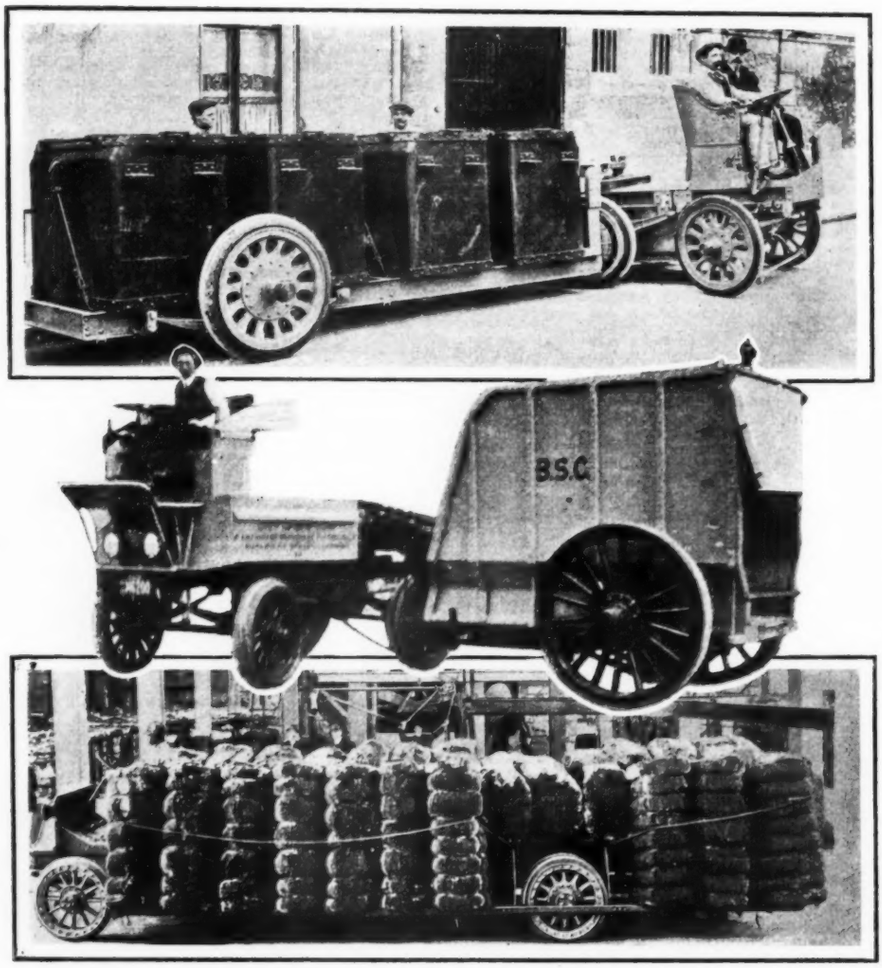
It is always advisable to have a one-gallon can of lubricating oil. There is no telling when this will come in handy. At least two two-gallon African water bags should be provided. These can be hung on the outside of the car, and it is surprising to find how cool the water will remain no matter how hot the sun. It is important to remember that in filling the water bags make inquiry from local people whether the water is good to drink or alkali. A little of the latter will not hurt for radiator use, but it is very disagreeable to the average constitution.

The most useful thing not only for sand, but because it comes in handy for other things, is 100 feet of 1-inch manilla rope.

Two-ton electric lumber tractor with trailer. The batteries are situated in a single front compartment and the lumber is mounted on a two-wheeled truck. The old and new methods are contrasted

Commercial Electrics for Special Needs

Electric Vehicles for Hauling Lumber and Cotton; for Freight Handling; Road Making and Garbage Disposal



Upper—The modern way of collecting garbage. The low frame allows easy loading
Middle—Five-ton electric street cleaning tractor made by the General Vehicle company for use in New York City
Lower—Six-ton electric built especially for moving cotton. Loading is facilitated by the underslung frame

THE adaptability of the electric truck to individual needs is well illustrated by the accompanying photographs which show electric machines in various lines of work. There are tractors for moving lumber, and for hauling garbage and refuse; electric street sprinklers, and road makers equipped with crane and roller; an electric curb-laying machine; small freight trucks for transporting goods from freight car to delivery truck and for carrying goods from department to department in large factories; there are underslung trucks for carrying large loads of cotton, and many other types.

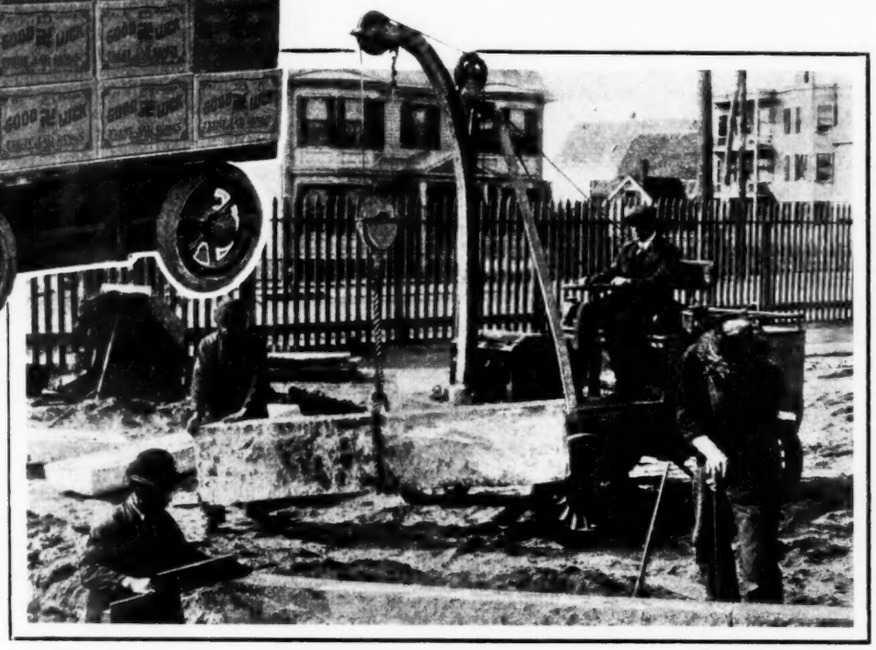
Consider the handling of cotton, for instance. Down in Savannah cotton is moved by electric stevedores across the great piers into the holds of the steamers which take it North. At the Bush docks in Brooklyn the same cotton is placed in freight cars by battery truck cranes. It is taken out of the cars at the mills by industrial trucks and moved to storage and then to the spinning room by them. Later the bobbins, dye tubs, and beams are moved from mill to mill by small electrics, while in the mill yards the 2 and 3.5-ton trucks are delivering supplies or loading finished goods.

The building of special trucks began over 10 years ago, although rapid development has only occurred in the past 6 years. Electric coal trucks with hand-operated dumping bodies appeared in 1902 and winch-equipped trucks for handling safes in 1903.

NOTE — The accompanying illustrations and information are taken from the paper entitled "Special Applications of the Electric Truck" read by F. Nelson Carle before the Electric Vehicle Assn. of America at the convention held in Philadelphia October 19-21.

Top—Fleet of 1-ton electric freight trucks. It is these machines that allow the rapid handling of freight, thus relieving congestion and providing greater freight capacity

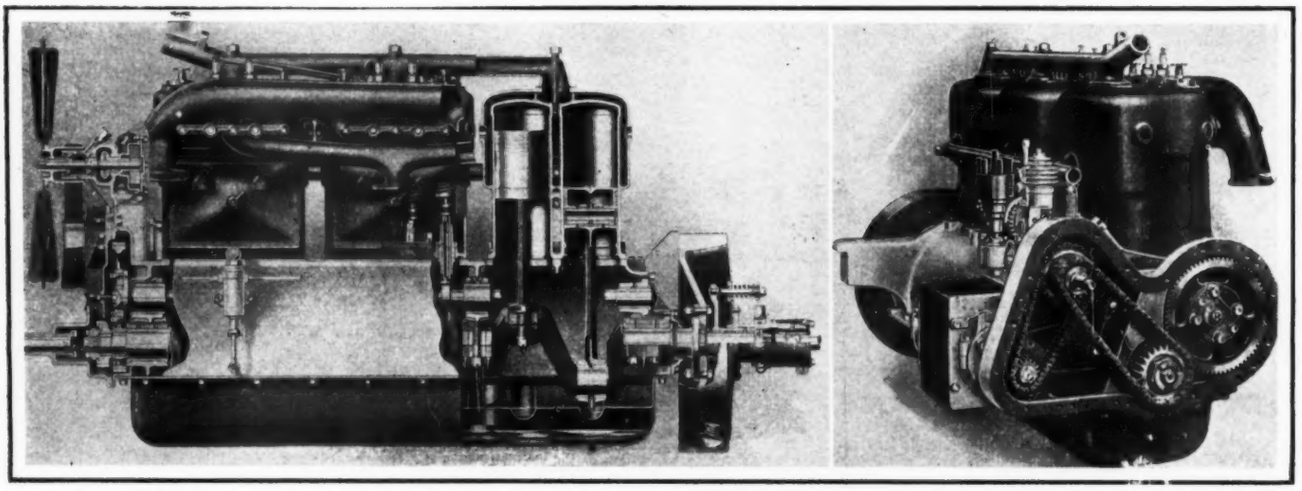
Right—One-ton freight truck moving goods from a freight car to the delivery platform



One-ton truck laying curb stone. The stones are picked up by the crane, carried to the trench in which the curb is laid and carefully lowered in place. With this device more curb can be laid with less men

Two applications of the electric to municipal work. At the left is a one-ton machine used in road making and at the right a street sprinkler. The crane on the former may be used for laying curbing or flagging, installing fire hydrants, etc.

Mitchell Adds Six Selling for $1,585



Left—Part section of new Mitchell six motor. Note exhaust carried forward. Right—Another view, with timing gear cover removed

Accessibility a Feature—L-Head Motor 4 by 5.5 Inches Used—Three Body Styles Offered

A NEW six at $1,585 has been brought out by the Mitchell-Lewis Motor Co., Racine, Wis. It has an L-head motor with cylinders 4 by 5.5 inches and is made in two, five and six-passenger body-styles. The wheelbase is 128 inches and 36 by 4 tires with demountable rims are used.

In addition to this model, the Mitchell company will continue the four-cylinder car at $1,250, the special six at $1,895 and the de luxe six at $2,350 which constitute the remainder of the line.

Several new features are found on the new six. The water pump is mounted behind the fan and is driven from the fan spindle. Adjustable inclosed silent chains are employed to drive the motor generator and ignition shafts. A power tire pump is standard equipment, being operated through sliding gears from the ignition shaft. More uniform cooling and great accessibility are obtained by reversing the position of the exhaust manifold so that the gases leave at the front end instead of at the rear. It is stated that the extensive use of chrome-vanadium steel and steel stampings have been big factors in reducing weight and at the same time increasing the strength and economy of this car.

Accessibility a Feature

Accessibility has been made a feature, it is stated, it being possible to remove the whole power plant and gearshift without disturbing the body. Each unit and portions thereof can be lifted out without touching adjacent units.

The motor of the new six has the cylinders cast in pairs. The crankcase is a barrel type aluminum casting having a removable lower cover of pressed steel which forms the splash basins and oil reservoir of the circulating oil system.

The crankshaft which is offset 1 inch from the center of the cylinders is mounted on four babbitt bearings 2.12 inches in diameter. The front one is 3 inches long, the two center ones 2.25 inches and the rear one 3.5 inches. Connecting-rods are I-beam sections having 2.12 by 2.25-inch babbitt bearings on the crankshaft. The piston pins are 1.12 inches in diameter and 1.813 inches long, are bushed with bronze, and are hollow. They are prevented from turning by Woodruff keys and brass disks separate the ends from the cylinder walls. Ground cast iron pistons are employed each having three rings with staggered joints. Small holes are drilled through the machined oil grooves around the pistons to allow the surplus oil to drain back into the crank chamber instead of working up into the combustion chamber.

Chrome nickel steel valves 1.93 inches in diameter and with 45-degree bevel seats are used. The inlet valves have .3125-inch lift and the exhaust .375-inch lift. The push rods have mushroom ends and adjustable tops.

The camshaft is a one-piece drop-forging It is driven from the crankshaft by helical gears. The four bearings have the following dimensions: Front, 2.56 by 2.03; two center, 1.75 by 2.03; rear, 2.436 by 1.25.

Lubrication of the motor is by means of a circulating splash system in which a plunger pump mounted at the right of the motor in an accessible position and driven by an eccentric on the camshaft draws oil from the base of the motor and distributes it through two leads through the engine gearcase and sight on the dash to the troughs and splash basins.

The overflow from these basins returns to the reservoir in the base of the motor. There is a float indicator on the side of the crankcase to show the amount of oil and nearby is the oil filler.

A feature of this system is that a separate lead with an adjustable feed valve branches off from the main return lead from the sight feed on the dash and conducts oil to the clutch bearing. Another feature is the arrangement of the breather openings in the valve spring compartments, thus lubricating the valve mechanism.

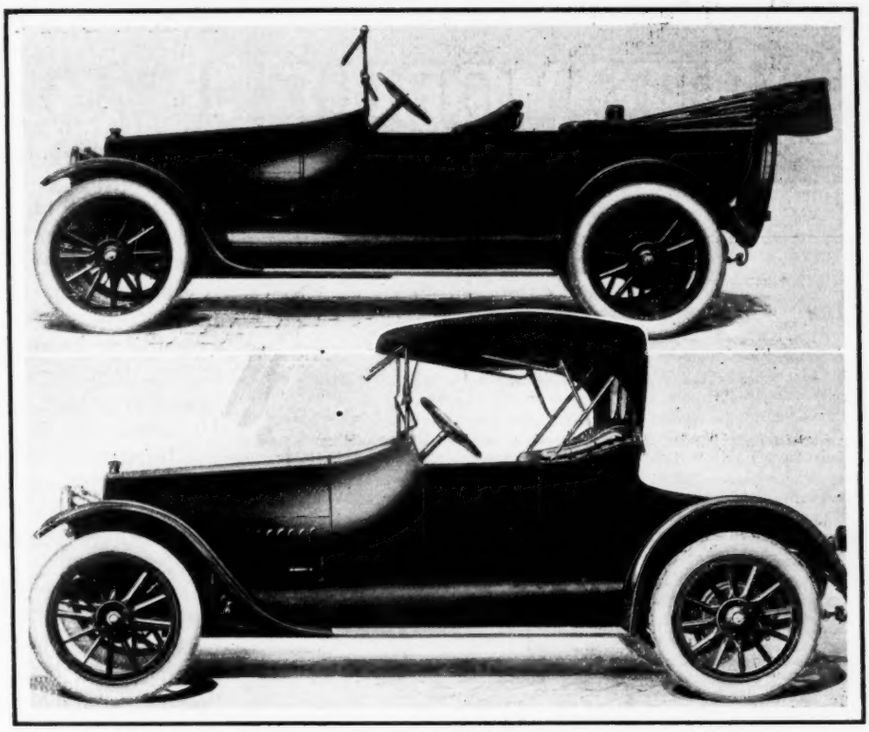
New Cooling Features

Several new details are noted in the cooling system. As previously pointed out, the centrifugal pump is mounted on the fanshaft where it is accessible and, should the fan belt break, the circulation would be maintained automatically, as the system is designed to operate on the thermo-syphon sys-

tem in such event. Better cooling is said to be obtained by carrying the exhaust pipe forward, producing more uniform cooling of the different cylinders. In addition it prevents the undue heating of the floorboards. The radiator has a removable shell which is built entirely separate from the radiator, which makes it possible to give the removable shell three coats of oven-baked enamel, thus insuring a durable finish. The radiator is mounted on flexible brackets.

Ignition is by means of a high-tension breaker and distributer system of Continental make in which the battery furnishes the current until the electric generator cuts into operation and supplies current. Starting and lighting are accomplished by means of a single unit motor-generator mounted on the right side of the crankcase at the front. It is a Splitdorf-Apple 12-volt design. The battery is suspended inside the frame under the rear floorboards. The head lights are wired so as to be operated in series or parallel, the former giving dimmed lights for city driving.

A special Rayfield carbureter is employed which may be easily primed or adjusted from the driver's seat. Fuel feed is by means of the Stewart-Warner vacuum gravity system from an 18-gallon tank mounted at the rear of the chassis. A gasoline gauge is fitted.



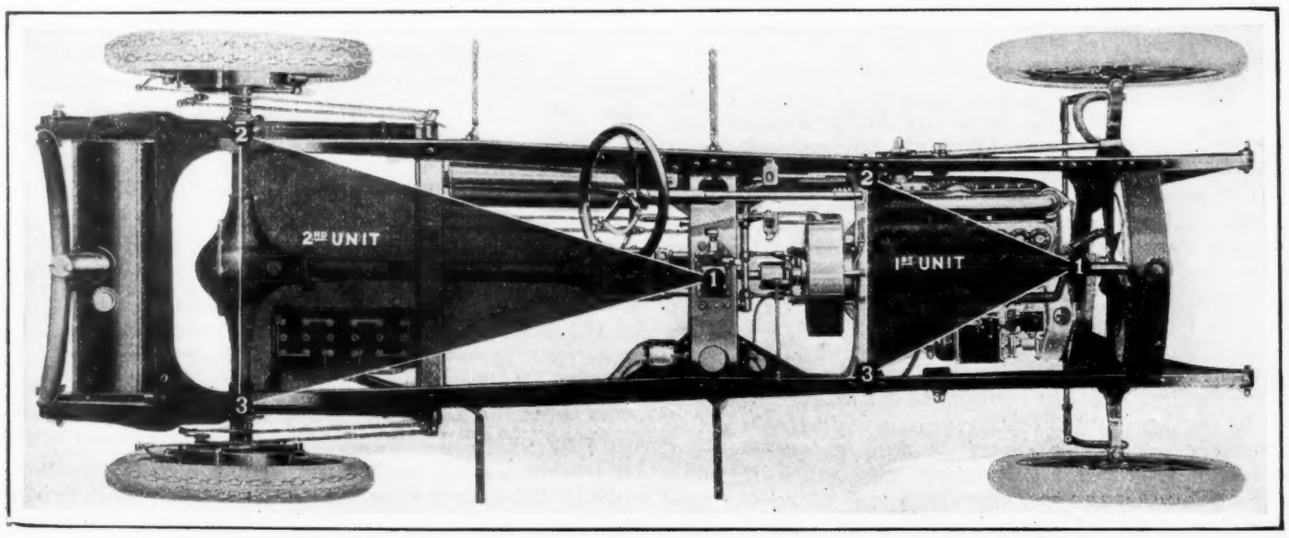
Above—Six-passenger touring body on new Mitchell six chassis
Lower—Two-passenger roadster

The clutch is a pressed steel cone, faced with leather and provided with springs to give an easy engagement.

The gearset is located at the front of the torsion tube thus dividing the power plant into two units, one the motor and clutch and the other the gearset and rear axle. The gearset is a sliding gear selective type having three speeds forward and one reverse. The gearbox is mounted at the front end of the torsion tube and is supported by a trunnion from the cross member of the frame. The countershaft is placed below the mainshaft which is squared to carry the sliding gears. Single and double row annular ball bearings and roller bearings are employed in the gearbox. The gears are made of chrome-vanadium steel and have 1-inch faces.

The driveshaft is bolted to both the gearset and rear axle housing. The axle is floating and accessible through a large cover plate at the back of the housing. The pinion is mounted on a double-row ball bearing in front and a double one behind, and has ball thrust bearings as well. The bevel gear and differential unit is mounted on roller bearings provided with a ball thrust. Driveshafts have splined ends and are easily removable. A standard gear ratio of 4 to 1 is furnished, but there are several others to order. The brakes act on 14-inch drums on the rear wheels, the pedal operating the external set and the lever the internal. The bands are lined with a non-burnable asbestos fabric, and conveniently located turnbuckles are provided to facilitate adjustment.

Three-quarter elliptic springs 2.25 inches wide and 50 inches long are used in the rear and the front springs are flat, half-elliptics 2 inches wide and 40 inches long. Steering is by means of an irreversible worm and gear.



Mitchell four chassis, showing three-point suspended double unit construction used in new six

The Automobile

PUBLISHED WEEKLY

Vol. XXXI Thursday, December 10, 1914 No. 24

THE CLASS JOURNAL COMPANY
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W. I. Ralph, Vice-President E. M. Corey, Treasurer
231-241 West 39th Street, New York City

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SUBSCRIPTION RATES
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Other Countries in Postal Union, including Canada --------- One Year, 5.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order, or Register your letter.

Entered at New York, N. Y., as second-class matter.
Member of the Audit Bureau of Circulations.
The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Truck Trash?

IN no more euphonious terms than "truck trash" are some English makers and publications designating much of the truck purchases made in America by some of the Allies.

England, or any other country, has got incorrect information on much of the American buying. One ally sent her representatives here and today has purchased over 2,500 trucks from reputable makers which cannot be considered trash, neither can any of these makers be considered as getting rid of products, rather, they are manufacturing their best goods for the foreign trade. They are testing them out perhaps a little better than might be done for home use, due solely to the extreme service in view.

It is certain that if foreigners form their conceptions of American trucks from the opinions expressed by many of the hordes of so-called brokers at present infesting our cities and looking for large middle-man profits there might be some possibility of some trash finding its way to the other side. But neither the Germans and Austrians, nor the Allies require to do business through such sources. Our truck makers are big enough to do business direct. All of the belligerent countries can feel safe in sending their emissaries direct to our factories. Our factories will stand inspection, the materials will stand analyses, the workmanship will stand the micrometer, in fact, they will find honestly made articles and not trash.

Patent Reciprocity

LAST week's action of the members of the National Automobile Chamber of Commerce, Inc., in which over half agreed to grant privileges on the patents they hold to others in the chamber holding patents and also granting reciprocal privileges, should go a long way toward limiting wholesale patent litigation, which is such a destructive force in any growing industry.

This new system, cross-licensing, is really patent reciprocity among those makers who control patents relating to automobile construction. There are over ninety members in this one association, and if all agree to patent reciprocity, it will at least assure for 10 years, the period of the agreement, that the patent legal mill will not be working so consistently on an over-time schedule as has been the case in the past.

No other agreement could better indicate the high spirit pervading the American automobile field, than this reciprocity one. It is how business men should get together. It is in harmony with the petitions presented before the Inter-State committee a year or so ago, when the automobile makers asked for a "peace policy," a time when they would be free to pursue the course of manufacture and merchandise, in contrast to a period when they would be irritated with the over-hanging cloud of over-legislation. The present act is a commendable step in the direction of eliminating an over-crop of automobile patent litigation.

This patent reciprocity is in line with the dominant thought with many automobile makers that they want patents as means of protection against those, who securing patents, might demand tribute from others who might have had a prior right to the patents. There is no thought in the present reciprocity program of diminishing the intrinsic value of a patent, there is not any thought of trying to reduce the value of a patent to the inventor, rather that patents will continue to be applied for and used as in the past, but that the individual automobile companies will use these patents for personal protection, against those who might demand tribute from the entire industry for their privileges.

It is estimated that at present there are over 900 patents controlled by those automobile makers, who are members of the present chamber, and under the proposed régime, the reciprocal use of these, or some of them, will be shared only by those companies that agree to pool their patents in this reciprocal scheme. Such a pooling of mutual interests should go a long way toward better protection for the makers so concerned, and it should result in a very considerable reduction in expenditures on patent litigation. In the last 2 decades there are examples of industries that have sapped much of their life blood by patent matters, and if this can be avoided it would seem a rational undertaking to avoid such. The working out of the present reciprocity scheme will be watched with more than ordinary interest, not only in the automobile field, but in other industries that have been long disturbed by the legal difficulties connected with patent suits.

Makers Cannot Maintain Prices Through Contracts with Dealers

Cincinnati Court Holds That License Contracts Involved Are Not of a Form Approved by Supreme Court

CINCINNATI, O., Dec. 8—Manufacturers' efforts to enforce price maintenance on their cars by means of contracts with their dealers are futile, according to the decision of the United States District court in Cincinnati, O. Judge Hollister of this court last week dismissed a bill of complaint brought by the Ford Motor Co., against the Union Motor Sales Co., Dayton, O., the basis of which was price-cutting.

The Union Motor Sales Co. is in a way a co-operative organization; customers are supposed to be stockholders, taking a $10 share of stock before sharing in the benefits of the company; goods were advertised at less than regular prices, and one of the favored items had been Ford cars.

Ford had declined to sell this company cars and in the suit which was brought about a year and a half ago charged that the Union Motor Sales Co. had conspired to obtain cars from regular Ford dealers, which cars were sold at less than list; this suit asked $50,000 damages and an injunction restraining the Motor Sales from selling any more Fords. A preliminary injunction was granted July 1, 1912.

A year later Ford charged Lucien A. Howard and O. D. Noble, of the Motor Sales, with contempt of court in continuing the forbidden practices; the charge was sustained in court. But within the past year or so there have been numerous high court opinions on price maintenance and these undoubtedly had much to do with Judge Hollister's ruling. He dismissed the Ford suit in its entirety.

Contracts Held Invalid

In the trial of the action it was proved that the Motor Sales had secured Fords and sold them to stock members at from 10 to 15 per cent. less than list. The Ford contracts, however, were declared invalid by Judge Hollister, whose opinion covers fourteen typewritten pages. He declared that the license contracts involved are not of a form approved by the United States Supreme Court. The Ford company's licenses are in connection with patents on its cars.

"The rights of the parties," ruled the court, "depend upon the construction to be given the written contracts entered into between the Ford Motor Co. and its so-called 'dealer licensees,' and so far no case involving a contract precisely like the agreement between the complainant and the dealers who sell cars made by it and covered by its patents has been presented to the Supreme Court.

"An agreement by the patentee, giving to another the rights to manufacture under the patent and to sell at a fixed price on a small royalty has been held not to come within the jurisdiction of the Sherman anti-trust act. (Bement vs. Harrow Co.)

"It is conceded that contracts such as made by the complainant with its dealers would, were it not for the fact that the article sold was made by the complainant under its patents, be contrary to public policy under the decisions in Dr. Miles Chemical Co. vs. Parke. But it is claimed that since the complainant does manufacture its cars under its own patents it has the right to maintain a monopoly of the exclusive right to sell, granted by the patent law, by a contract of sale with its dealers, fixing the price on resale at which the dealers may sell to the user, although by so doing the competition between the dealers is thereby effectually prevented.

"There is, however, a marked difference between these contracts and the license contracts to which the Supreme Court has given its approval. For, in this case, the patentee is the maker and does not, in terms at least, receive a royalty, but actually sells each machine at a price fixed by itself and is paid by the dealer all that the maker asks for the article sold. There is no question of restricted use in this case as in that of Henry vs. Dick, for the contract is either a complete sale of the exclusive right to sell given the complainant under the patent laws, or a license to sell, which involves a reservation of some part of the exclusive right to sell, or, as contradistinguished from these, amounts to a sale.

"For the purpose of this case it may be assumed that if the contract partakes of the quality of a sale of the exclusive right to sell, or of a license to sell, it is a good contract which the complainant may legally enter into with its dealers and, under the facts proved in this case, an injunction must be issued against the defendants.

"But if, under the terms of the contract, the complainant has sold the automobile made by it and delivered the sale to its dealers, passing the title upon the receipt of the contract price, then, under the decisions of the Supreme Court, and on principle, the conclusion in my judgment must be that by such sale the complainant * * * cannot legally fix the price at which the dealer shall re-sell. The contract does not deal with the use of the automobile sold; hence, to call it a contract for 'restricted sale' is a misnomer, and the adoption of such a definition is, as said by Mr. Justice Day, 'a mere play upon words' (Bauer vs. O'Donnell)." The latter is the famous Sanatogen case.

Besides the Union Motor Sales Co. the defendants were: Lucien A. Howard, J. Carl Horton, Early S. Sorsley and William T. S. Yokum, all of Dayton.

—

Horn Patent Litigation Draws to Close

NEW YORK CITY, Dec. 5—The order extending the term of the court for all purposes of the suit of the Lovell-McConnell Mfg. Co. against the Automobile Supply Mfg. Co. for 6 months from the date of the final decree was vacated yesterday by a memorandum issued by Judge Veeder.

It was brought out in the memorandum that, while an extension of the term was not required for the assertion of any rights remaining to the Lovell-McConnell company, the publicity given to the order had injuriously affected the Automobile Supply Mfg. Co. This suit is now at an end, unless the Klaxon makers petition for a hearing before the Supreme Court of the United States. The order in question was granted by Judge Chatfield October 31 on motion of the Klaxon counsel following the confirmation by the Circuit Court of Appeals of the decision of Judge Coxe handed down on June 8 in favor of the Automobile Supply Mfg. Co.

The memorandum was issued in the United States District Court for the Eastern District of New York.

—

Savage Motor Officials Freed of Fraud Charge

CINCINNATI, O., Dec. 7—The trial of Delbert H. Cummings, Robert W. Fishback and Edwin E. Taylor, president, vice-president and secretary respectively of the Savage Motor Co., charged with using the mails in a scheme to defraud was brought to an abrupt close in the United States court at Cincinnati last week when Judge Hollister ordered the jury to bring in a verdict for the defendants. He held that there was not sufficient evidence adduced showing an intent to defraud. The three men had received on an average about $200 in deposit each from about 300 agencies to handle the Savage 20 which was never placed on the market. The defendants claimed that it was because of their arrest that they were unable to place the car on the market.

—

DETROIT, MICH., Dec. 8—Henry B. Joy, president of the Packard Motor Car Co. and director of the Federal Reserve Bank, Chicago District, is convalescing in Roosevelt Hospital, this city, after having undergone a minor operation.

Mr. Joy recently sustained a bump on his head while on a test trip with an experimental car, resulting in a painful bruise. It was found several days later, after other symptoms had developed, that a slight surgical treatment was necessary. Reports indicate that the Packard executive will be discharged from the hospital within a very short period.

N. A. C. C. Recommends Interchange of Patent Licenses by Makers

Reciprocal Agreement Urged to Prevent Litigation Over the 900 Patents Owned by Members — Chamber Votes to Defend Axle Patent Suit

NEW YORK CITY, Dec. 5—Yesterday, at an important meeting held by the National Automobile Chamber of Commerce, the members showed the united condition of the automobile industry by recommending for general adoption by the industry a cross-licensing agreement which provides for makers to interchange licenses on patents which they own.

This interchange or cross-licensing system, which was signed by practically one-half of the companies present, is one of the most important steps taken by the chamber since its organization. There are now over 900 patents owned by the members, and by this cross-license scheme each maker grants the permission to use his patents to every other maker who reciprocates. The agreement takes effect January 1 and is for a 10-year period. The object of the cross-licensing system is to avoid patent litigation among members, who have patents taken out more for protective measures than for the purpose of securing revenue from them.

To Defend Axle Patent Suit

At the same session the members voted to take over the defense of the suit on rear axle patents brought by the Kardo Co. against the Studebaker Corp. in Chicago, as reported in THE AUTOMOBILE for November 19. It is stated that the members of the Chamber will follow the same course in the event of any other similar suits being brought against companies belonging to the organization.

Henry B. Joy, president of the Packard company, read a letter he had addressed to E. R. Benson of the Studebaker Corp., which was more or less in explanation of the Kardo litigation against the Studebaker company, which litigation was the real cause of the meeting. The latter was largely a reply to a circular distributed among the Chamber members and in which the statement had been made that the Kardo company was really organized to exact tribute by way of patent royalties from the industry. Mr. Joy refuted this and stated that if ninety-three of the largest automobile manufacturers are to band themselves together for the purpose of ignoring the rights of inventors that inventors should really seek the patent courts. Mr. Joy referred to the meeting of the Chamber on May 6, in which it outlined the policy of patent peace and referred to the present action as a complete change of direction in this matter. He said that the Kardo company soon after the May meeting sent to every member of the Chamber a list of Packard patents with an expressed willingness to grant licenses under any and all of them under reasonable terms, and that the company was ready and willing at all times to accord others exactly the same recognition of their patents that he asked for those of his company.

In regard to the recommendation for a cross-licensing agreement on patents, the thought was expressed that the industry has prospered by scientific manufacturing of a product of excellent quality, and that, while each company held some patents of great value, it would be better for the industry at large that each concern, while developing its own ideas and standards with the idea of building the best possible machines, should be free from attack on patents owned by the others. As General Manager Alfred Reeves of the Chamber expressed it, the whole thing resolved itself down to the question whether one maker's patents are more important than the entire balance of the industry. An idea of the disastrous possibilities in the way of patent litigation which are possible may be gained from the fact that members of the Chamber own between 900 and 1,000 patents and that there are at least six or seven important patents on each part used in car construction. Naturally, when the cross-licensing idea was proposed, there was an animated discussion although this was all along the same lines.

Trade Conditions Favorable

The discussion of general trade showed that the industry, aided by the favorable weather conditions and returning business prosperity, has more than held its own, even during the fall months. Export trade has suffered considerable, so far as passenger cars are concerned, on account of the war, although this is offset to a large degree by the sale of motor trucks to foreign countries.

President Clifton presided over the meeting at which were represented practically all the leading automobile manufacturers, as indicated by the accompanying list.

—

Aluminum and Petroleum Show Big Gains

NEW YORK CITY, Dec. 8—The Department of Commerce, Washington, D. C., has issued a statistical record of the progress of the United States from 1800 to 1914 and also the monetary, commercial, and financial statistics of the principal countries.

A number of the principal commodities show a remarkable growth, for instance, aluminum, whose production rose from the modest figure of 83 pounds in 1883 to 65,607,000 in 1912,

Attendance at the Meeting of Members N. A. C. C., December 3, 1914

Members	Representatives
Abbott Motor Car Co.	Alfred Reeves
Allen Motor Co.	J. E. Wright
Anderson Electric Car Co.	Wilson Kritzer
Argo Electric Veh. Co.	Wm. E. Metzger
Apperson Bros. Auto Co.	J. B. Eccleston
Autocar Company	John S. Clarke
Avery Company	F. A. Gundlach
Baker Motor Veh. Co.	Geo. H. Kelly
Borland-Grannis Co.	Wm. E. Metzger
Briscoe Motor Co.	Horace DeLisser
Broc Electric Veh. Co.	Wm. E. Metzger
Buick Motor Co.	Wilfred C. Leland
Cadillac Motor Car Co.	Wilfred C. Leland
Chalmers Motor Co.	Hugh Chalmers
Cartercar Company	Wilfred C. Leland
Chandler Motor Car Co.	F. C. Chandler
Cole Motor Car Co.	Wm. L. Colt
Jas. Cunningham, Son & Co.	F. E. Cunningham
Federal Motor Truck Co.	M. L. Pulcher
Dodge Brothers	A. I. Philp
F. I. A. T.	A. E. Schaaf
Garford Company	J. N. Willys
General Vehicle Co.	P. D. Wagoner
General Vehicle Co.	A. F. Macdonald
Gramm Motor Truck Co.	J. N. Willys
General Motors Truck Co.	Wilfred C. Leland
Hudson Motor Car Co.	H. E .Coffin
Hupp Motor Car Co.	J. Walter Drake
Inter-State Motor Co.	B. W. Twyman
King Motor Car Co.	Artemas Ward
Krit Motor Car Co.	H. W. Standard
Locomobile Co. of America	S. T. Davis, Jr.
Mack Bros. Motor Car Co.	Vernon Monroe
Maxwell Motor Co., Inc.	Carl H. Pelton
Maxwell Motor Co., Inc.	Carll Tucker
McFarlan Motor Co.	B. I. Barrows
Mercer Automobile Co.	Wm. T. White
Moline Automobile Co.	Wm. H. Van DerVort
Moon Motor Car Co.	E. J. Moon
Moon Motor Car Co.	W. J. Coghlan
National Motor Vehicle Co.	Geo. M. Dickson
Nordyke & Marmon Co.	C. C. Hanch
Oakland Motor Car Co.	Wilfred C. Leland
Ohio Electric Car Co.	H. P. Dodge
Olds Motor Works	Wilfred C. Leland
Packard Motor Car Co.	Alvan Macauley
Packard Motor Car Co.	Henry B. Joy
Packard Motor Car Co.	M. J. Budlong
Paige-Detroit Motor Car Co.	J. F. Bourquin
Pierce-Arrow Motor Car Co.	Charles Clifton
Premier Motor Mfg. Co.	H. O. Smith
Rauch & Lang Carriage Co.	E. J. Stahl
Reo Motor Car Co.	H. T. Thomas
Selden Motor Vehicle Co.	R. H. Salmons
Studebaker Corporation	E. R. Benson
Stutz Motor Car Co.	H. F. Campbell
Walter Motor Truck Co.	C. W. Fletcher
Waverley Company	H. H. Rice
Willys-Overland Company	John N. Willys
Winton Motor Car Co.	C. W. Churchill
Alfred Reeves	General Manager

the latest estimate. This metal, which was first manufactured commercially in 1889, showed a production that year of 47,468 pounds. In 2 years it jumped to 150,000 and in 1896, went over the million mark, the exact figures being 1,300,000. In 1906, the production reached 14,910,000 pounds, and that mark was practically doubled in 2 more years, the figures being 34,210,000.

Petroleum also showed a large increase. In 1859, the first year it was used in this country for commercial purposes, 84,000 gallons were produced. This product immediately showed signs of a tremendous production, the next year's production being 21,000,000 gallons. In 1862 the production jumped to 128,380,980 gallons. In addition to this amount it is estimated that 10,000,000 barrels ran to waste in and prior to that year. The next 3 years showed a decrease, after which the production picked up and a gradual increase occurred up to 1875, when the production was 510,825,588 gallons. This included all the production prior to 1876 in Ohio, West Virginia, and California. The 2,000,000,000-gallon mark was reached in 1891, the exact figures being 2,280,291,510. From then on the increase was steady, the latest figures being in 1913 with a production of 10,434,741,660 gallons.

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N. Y. Garagemen Confer on Fire Regulations

NEW YORK CITY, Dec. 9—The Automobile Trade Assn. of New York State has compiled data as to the effect if the temporarily suspended rules of State Fire Marshal John F. Ahearn were enforced and will meet that official today in Albany, prepared to help revise the regulations so that the drastic features will be eliminated. It will be proposed that certain sections be struck out and that others be altered.

The association sent to garagemen a question blank, asking what the enforcement of the rules would mean. The replies indicate that it would cost more to remodel existing buildings in accordance with the rules than it would to build new structures; the cost in many cases was from $10,000 to $15,000.

This morning, Wednesday, December 9, the Board of Directors of the association will meet in Albany and will discuss plans for the meeting with the fire marshal in the afternoon. Besides the directors the conference will be attended by President R. H. Johnston, Secretary Charles A. Stewart and Attorney Charles Thaddeus Terry.

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Boston Dealers Continue Separator Fight

BOSTON, MASS., Dec. 5—Next week it is expected that the matter of whether or not all the garages and service stations of the motor dealers in what is termed Metropolitan Boston, which embraces Boston and surrounding cities and towns within an area of about 15 miles, will have to install separators at a cost of several hundred dollars each. It would not be surprising if Fire Hazard Commissioner John A. O'Keefe, who has the last say in the matter, would compromise with the motor organizations and frame rules guaranteed to prevent danger without the necessity of every one installing a separator. If that is done it will be the result of energetic, intelligent action on the part of the officers of the automobile organizations, who have been working on the matter.

Chester I. Campbell of the Boston Automobile Dealers' Assn. has prepared a series of questions which have been printed on blanks that will be circulated to all garages in the city. These questions aim at securing complete information relative to Boston garages, gasoline storage systems, pumps, etc., and should assist in reaching a definite conclusion regarding whether separators are necessary or not.

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New York Men Form State Federation

NEW YORK CITY, Dec. 8—There is being organized today in Syracuse, N. Y., the New York State Federation, an organization of motorists, which is breaking away from the New York State Automobile Assn., the state body federated with the American Automobile Assn. The new organization is a result of opposition to the older organization and it is expected that the three big motor organizations of the state, namely, clubs from Buffalo, Rochester, Syracuse and the Metropolitan Consulate of this city will combine in the new organization, giving a total membership of approximately 10,000. With this loss the old organization will have approximately 6,000 remaining members. The new Federation will affiliate itself with the A. A. A. by its clubs joining individually.

California Has New H.P. Formula

State Officials Devise Way to Raise Its Long-Stroke Motor Fees for 1915—A War Tax

LOS ANGELES, CAL., Dec. 3—P. F. Meckes of the Los Angeles branch of the California State Motor Vehicle Dept., returned from Sacramento yesterday afternoon with the formula that is to be used next year for determining horsepower on motors to be taxed in this state. The formula is: Bore + stroke × bore × number of cylinders × .224.

The owner of a long-stroke motor pays from $5 to $10 more under this system. Local dealers and prominent motorists are greatly opposed to the new formula and there is a lot of talk about taking the matter to court to get a decision on what is a horsepower.

It is argued that either the State of California was flimflammed out of $150,000 last year, or the motorists are to lose that amount this season.

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War Tax for Car Owners

NEW YORK CITY, Dec. 4—Automobile owners and applicants for chauffeurs' licenses must help pay the new revenue tax, J. A. Parsons, Attorney General, decided today. The Secretary of State was uncertain as to the application of the new law to his office, and asked Mr. Parsons for a ruling.

The tax will be 10 cents more for the 1915 privileges than was paid last year. There are 166,961 automobiles registered and about 75,000 chauffeurs; this will give the Government about $25,000. This is in pursuance of the stamp tax law passed by Congress, October 22.

Every applicant must send with his application a 10-cent revenue stamp, left loose for affixing by the office issuing the papers.

Over in New Jersey Commissioner of Motor Vehicles J. H. Lippincott, acting under an opinion of Attorney-General Westcott, announced recently that war revenue stamps were required on the application for license cards.

The special taxes are as follows:

Car registration certificate, 10 cents; motorcycle registration certificate, 10 cents; driver's license certificate, 10 cents; learner's permit certificate, 10 cents; all duplicates and transfers, 10 cents; power of attorney for non-residents, 25 cents and affidavit on application, 10 cents.

The State of Maryland is also demanding from each applicant for registration a tax of 10 cents. This went into effect December 1. Each application must bear a 10-cent stamp hereafter.

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Pennsylvanians Want State Road Tax

PHILADELPHIA, PA., Dec. 4—At a special meeting called yesterday to consider prospective new legislation at Harrisburg of interest to automobilists, various methods of providing for early improvement of Pennsylvania's roads were discussed by the Executive Committee of the Pennsylvania Motor Federation at the Automobile Club of Philadelphia.

After several speakers had been heard, ex-State Senator Adams, chairman of the legislative committee, was instructed to draft a bill at the coming session of the state legislature providing for the levying of a special state road tax on all taxables, individual and corporation, who now pay a state tax, and including real estate that pays no state tax.

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States Want Uniform Traffic Regulations

NEW YORK CITY, Dec. 7—Conferences recently held in this city and Trenton, N. J., by representatives from this state, New Jersey, Pennsylvania, Maryland, Delaware, the District of Columbia and the New England States, point towards the adoption in the near future of uniform traffic regulations there.

A commission has been appointed in New Jersey by Governor Fielder composed of J. H. Lippincott, commissioner of motor vehicles, chairman; A. V. Hamburg, president of the Newark board of trade, and G. B. LaBarre, director of public safety of Trenton.

October Exports Total $3,055,351

672 Trucks and 732 Passenger Cars Are Shipped—Trucks Gain 593 Machines Over 1913

WASHINGTON, D. C., Dec. 8—The large demand for commercial cars as a result of the European war is shown in the October exports, made public today by the Federal Bureau of Statistics. In that month 672 commercial cars, valued at $2,286,964, and 732 pleasure cars, valued at $768,387, were exported, as against seventy-nine commercial cars, valued at $129,506 and 1,697 pleasure cars valued at $1,663,716, exported in the same month last year. The exports for the 10 months ended October last were, 1,309 commercial cars valued at $3,353,509 and 20,262 pleasure cars, valued at $17,888,351.

P. O. Dept. Bids for Tires Dec. 16

WASHINGTON, D. C., Dec. 8—The Postoffice Dept. will open bids on December 16 for furnishing pneumatic, solid or cushion tires for the postoffice motor cars. Information for the bidders will be furnished by the purchasing agent of the department, this city.

WASHINGTON, D. C., Dec. 8—The Duplex Power Co., Charlotte, Mich., has been awarded a contract to furnish the Quartermaster Dept. of the War Dept., two four-wheel-drive trucks.

LIMA, O., Dec. 8—The Gramm-Bernstein Co., Lima, O., has booked an order for twenty-five trucks to be used by the departments of the Federal Government at Washington, D. C.

Two $1,900 Worm-Driven Federal Trucks

DETROIT, MICH., Dec. 5—The Federal Motor Truck Co., which thus far has made only chain-driven trucks, is now placing on the market two worm-driven models, both of 1 1-2 ton capacity.

Both models sell at $1,900 and while model J has a wheelbase of 120 inches, Model K's wheelbase is 144 inches. Both have a Continental motor, 4 1-8 by 5 1-4. The sizes of the tires are 36 by 3 1-2 on the front wheels and 36 by 5 on the rear wheels, or dual tires.

$725 Crow with Electric Starting and Lighting

ELKHART, IND., Dec. 8—The Crow Motor Car Co., Elkhart, Ind., has made public the first details of a new five-passenger model which is to sell for $725 with electric lighting and starting and otherwise fully equipped. It is fitted with a 25-28 horsepower block motor, supported at three points, a multiple disk clutch, a four-speed selective gearset and a full floating axle. The body conforms to the modern streamline principles and is built on a wheelbase of 104 inches. The gasoline tank is in the cowl and the spring suspension includes the usual semi-elliptic front members with underslung three-quarter elliptics in the rear. The equipment includes electric horn, top, windshield, Stewart speedometer and oversize tires.

Waverley Shop Trucks for Government

INDIANAPOLIS, IND., Dec. 8—The Waverley company of Indianapolis has under construction for the Navy Yard on Puget Sound, Washington, a 3-ton electric shop truck with 3-ton trailer for handling plates and angles from storage to machines and from machine to machine through the Naval Repair Shop.

The tractor is of unusual design in that with a wheelbase of 66 inches the platform of the car is 5 by 11 feet, the principal overhang being in front of the front axle.

The battery of forty-two cells is divided between two battery boxes, one between the wheels and the other under the forward overhang.

Mounted on the platform of each car is a turntable 5 feet 2 inches in diameter running on rollers and operated by hand spikes for the quick and convenient unloading of the heavy plates or beams it is designed to carry.

The construction of both cars is very substantial, wheels axles, frames, turntables and all being of heavy steel. A single motor is used and the power is transmitted to the rear axle by means of a worm-gear-shaft drive.

A mileage of 30 miles on a single charge of the battery is provided and a speed of 5 1-2 miles an hour with both cars fully loaded.

Storms Electric Leases Mercury Plant

DETROIT, MICH., Dec. 5—The Storms Electric Car Co., which was organized last week, has leased the plant formerly occupied by the Mercury Cyclecar Co., 807 Scotten avenue. This is a two-story structure having about 25,000 square feet of floorspace. The first models of the Storms electrics are now being completed and will be shown at the Detroit automobile show, in January.

N. Y. Stock Exchange Opens Dec. 12

NEW YORK CITY, Dec. 8—The New York Stock Exchange will open Saturday, December 12. The Governors have voted to permit restricted trading in stocks on the floor of the Exchange starting that day, after being closed 19 weeks, since July 30,

Approximately 175 stocks will be traded in cash or regular way only. Dealings in stocks as such shall be specified by, and be under the supervision and regulation of, the committee of five, shall be for cash or regular way only and not below the minimum prices authorized by the committee from time to time. Transactions at prices below those allowed by the committee, or in evasion of its rules, are prohibited.

Automobile Securities Quotations

NEW YORK CITY, Dec. 8—A general strengthening of the automobile security market was perceptible during the past week. Kelly-Springfield Tire established a new high record and several other stocks showed substantial gains. The following bid and asked quotations are those which a prominent brokerage house finds to obtain in private sales and are to be taken only as a guide until the reopening of the Stock Exchange.

	1913		1914	
	Bid	Asked	Bid	Asked
Ajax-Grieb Rubber Co. com	200	225	250	..
Ajax-Grieb Rubber Co. pfd	97	102	100	..
Aluminum Castings pfd	98	101	95	100
J. I. Case pfd	..	..	..	..
Chalmers Motor Co. com	..	95	..	94
Chalmers Motor Co. pfd	..	96	87½	92½
Electric Storage Battery Co	..	..	48	49
Firestone Tire & Rubber Co. com	..	250	340	..
Firestone Tire & Rubber Co. pfd	102	104	110	110
Garford Co. pfd	80	90	..	..
General Motors Co. com	36	37	75	75
General Motors Co. pfd	73	74½	86	87½
B. F. Goodrich Co. com	16	17	25½	26½
B. F. Goodrich Co. pfd	78	79	88	..
Goodyear Tire & Rubber Co. com	200	210	180	185
Goodyear Tire & Rubber Co. pfd	93	95	100	102
Gray & Davis, Inc., pfd	95	100	..	..
International Motor Co. com	..	5	..	..
International Motor Co. pfd	..	15	..	..
Kelly-Springfield Tire Co. com	..	..	66½	68
Kelly-Springfield Tire Co. 1st pfd	..	..	75	80
Kelly-Springfield Tire Co. 2d pfd	..	..	90	95
Lozier Motor Co. com	..	16	..	..
Lozier Motor Co. pfd	..	90	..	..
Maxwell Motor Co. com	2	2½	13¾	14
Maxwell Motor Co. 1st pfd	18	19½	43	44
Maxwell Motor Co., 2d pfd	5½	6¼	16	18
Miller Rubber Co	120	130	160	..
New Departure Mfg. Co. com	..	..	..	..
New Departure Mfg. Co. pfd	..	..	..	..
Packard Motor Car Co. com	..	..	..	100
Packard Motor Car Co. pfd	91	94	90	..
Peerless Motor Car Co. com	..	25	15	20
Peerless Motor Car Co. pfd	..	85	..	55
Pope Manufacturing Co. com	..	3	..	..
Pope Manufacturing Co. pfd	..	15	..	..
Portage Rubber Co. com	..	35	25	30
Portage Rubber Co. pfd	..	90	80	85
*Reo Motor Truck Co	..	7⅛	10¼	11¼
*Reo Motor Car Co	..	15½	21½	22¾
Splitdorf Electric Co. pfd	..	..	..	..
Stewart-Warner Speedometer Corp. com	50	55	46¾	47¾
Stewart-Warner Speedometer Corp. pfd	96	97	97	100
Studebaker Corporation com	14½	15¾	35	37
Studebaker Corporation pfd	65½	68	86	88
Swinehart Tire & Rubber Co	78	80	69	71
Texas Company	..	..	126	..
U. S. Rubber Co. com	53½	54½	45	47
U. S. Rubber Co. pfd	98½	99	95	97
Vacuum Oil Co	..	..	203	208
White Company pfd	104	110	108	110
Willys-Overland Co. com	58	60	76½	80
Willys-Overland Co. pfd	82	88	86	88

*Par value $10; all others $100 par value.

Goodyear Profits $3,391,165 for Year

$1,183,418 Is Reserved for Depreciation—Unappropriated Surplus of $4,052,395 Remaining

AKRON, O., Dec. 8—The Goodyear Tire & Rubber Co.'s net income for the year amounted to $3,391,165. Additional credits not applicable to the operations for the current year amounted to $38,062. Additional debits not applicable to the current earnings amounted to $154,560. There remains an unappropriated surplus of $4,052,395.

F. A. Seiberling, president of the Goodyear company, in his remarks to the stockholders at their annual meeting says:

"Increases to the plant have been carefully received. The reserve for depreciation amounting to $1,183,418 is equivalent to 18.63 per cent. of the plant value of $6,351,250 as of October 31, 1913. The inventory was taken by the company by actual count, weight or measurement under the supervision of the company's factory superintendent and has been certified by him. It is priced at cost or under including crude rubber, which latter commodity is priced both under cost and under the present market value."

In 1913 the company did a gross business amounting to $32,500,000, an increase of $7,000,000 over 1912. The net profits were $2,041,000, equal to 33 per cent. on the common stock.

During 1914, by charter amendment the authorized preferred capital stock was increased from $5,000,000 to $7,000,000 and the common capital stock reduced from $10,000,000 to $7,991,110. In 1913 the company had outstanding $5,000,000 preferred and $5,033,800 common. The balance sheet as of October 31, 1913, shows a reserve for accounts and depreciation of $1,367,390, and a surplus of $2,820,071. The company during 1913 built large additions to its factory costing $2,495,680.

The balance sheet as of Oct. 31 last compares as follows:

Assets	1914	1913
Real estate and buildings	$3,606,537	$3,493,535
Machinery and fixtures	3,208,107	2,857,714
Patents, trade marks designed	1	1
Securities owned	777,649	804,904
Notes receivable of officers and employers for capital stock	805,283	136,882
Pfd. stock purchased and held in treasury	343,593	.....
Inventory	4,567,460	4,677,426
Accts. and notes receivable	3,328,693	4,117,086
Advances to agents, salesmen and companies	280,665	137,313
Cash on deposit and on hand	2,862,706	1,141,220
Advances to Goodyear Improv. Co. and Goodyear Heights Realty Co	885,315	719,312
Suspended assets	440,438	430,156
Prepaid rentals, insurance, etc	352,893	342,698
Total	$21,459,335	$18,858,251
Liabilities		
Preferred stock	$7,000,000	$5,000,000
Common stock	7,991,110	5,033,800
Purchase accounts payable	410,575	702,384
Notes payable	.....	3,653,000
Sundry other accounts payable	257,509	281,606
Reserve for doubtful accounts	564,327	508,481
Reserve for depreciation of plant	1,183,418	858,909
Surplus	4,052,395	2,820,071
Total	$21,459,335	$18,858,251

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Studebaker 1914 Profits Estimated Double 1913

NEW YORK CITY, Dec. 7—Net profits of the Studebaker Corp. for 1914 will be more than twice as great as in 1913, according to information. On the basis of actual figures for the 9 months ending September 30, it is estimated the profits, after depreciation and interest charges, will be about $4,000,000, comparing with $1,904,823 last year. Accordingly the surplus available for dividends on the common stock would be equal to 11 per cent. on the $27,931,600 stock outstanding.

Since January 1 the company's serial notes outstanding have been reduced from $6,800,000 to $5,800,000. In addition to the $800,000 that matured, the company cancelled $200,000 bought in the open market.

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E. H. Huxley Heads U. S. Rubber Export Co.

NEW YORK CITY, Dec. 4—Organization of the United States Rubber Export Co., Ltd., incorporated last week with a capital of $100,000 under the laws of Delaware, was completed yesterday by the election of these directors: S. P. Colt, president of the U. S. Rubber Co.; Lester Leland and J. B. Ford, vice-presidents of the same concern; E. S. Williams, president of the Rubber Goods Mfg. Co.; H. E. Sawyer, general manager of the United States Rubber Co.; R. B. Rice, C. C. Case, W. E. Barker, J. C. Weston, E. H. Huxley, H. S. Hotchkiss and W. J. Maloney.

These directors elected the following officers: President, E. H. Huxley; treasurer, W. C. Parson; assistant treasurer, H. S. Hotchkiss, and secretary, J. D. Carberry. The new export company has been organized for the purpose of consolidating the export business of the United States Rubber Co. and its associate companies.

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Indianapolis to List Used Car Sales

INDIANAPOLIS, IND., Dec. 8—If an ordinance which the Indianapolis council has under consideration becomes effective, dealers in used cars, parts and accessories will be required to list all purchases with the police department. The ordinance contemplates detailed reports which must be made out within 24 hours after every purchase. A heavy fine, to which a jail sentence may be added, is provided for conviction for violations.

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NEWARK, O., Dec. 8—The board of trade of Newark, O., at a recent meeting pledged both moral and financial support to the Blair Motor Truck Co., which was recently organized to manufacture motor buses. A committee of five was named to confer with the officials of the company with reference to its needs. It was stated that about $60,000 additional capital was needed to take care of orders which have been booked.

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Market Reports for the Week

Market reports this week remained generally unchanged. There were a few unimportant changes such as the drop of $0.25 per 100 pounds for tin, the slight decline of both coppers, the rise of rapeseed oil to $0.72, rubber closing at $0.71 at a gain of $0.01 and the raw Japanese silk gain of $0.02. The sales in tin were few with very little demand for either spot or future positions. The demand for copper was light and selling interests were more anxious to make sales, especially for nearby delivery. Even late futures were weaker in tone. In Europe apparently prices of electrolytic were nominally unchanged, but slightly easier in tone. Antimony is steady for spot and firmer for future delivery. Lead remained quiet but steady. Cottonseed oil, which went up $0.22 per barrel held a better tone this week with an improved consuming demand. There was absence of new developments of importance in the crude rubber market. Though there was a gain of $0.01, prices were generally steady. The demand from manufacturers was reported as light. In discussing the embargo placed by England on shipments of plantation rubber a large manufacturer of tires states that two ships bearing crude rubber reached this country during the last few days, and that there is only one other ship bearing rubber on the high seas bound for the United States. This ship left Singapore before the establishment of the embargo.

Material	Wed.	Thurs.	Fri.	Sat.	Mon.	Tues.	Week's Changes
Antimony	.13½	.13½	.13½	.13½	.13½	.13½	.....
Beams & Channels, 100 lbs.	1.21	1.21	1.21	1.21	1.21	1.21	.....
Bessemer Steel, ton	18.00	18.00	18.00	18.00	18.00	18.00	.....
Copper, Elec., lb.	.12¾	.12¾	.12¾	.12⅝	.12⁷⁄₁₀	.12⁷⁄₁₀	—.00¹⁄₂₀
Copper, Lake, lb.	.12⅞	.12⅞	.12⅞	.12⁹⁄₁₀	.12⅝	.12⅝	—.00³⁄₄₀
Cottonseed Oil, bbl.	5.63	5.68	5.86	6.00	5.91	5.85	+.22
Cyanide Potash, lb.	.23	.23	.23	.23	.23	.23	.....
Fish Oil, Menhaden, Brown	.38	.38	.38	.38	.38	.38	.....
Gasoline, Auto, bbl.	.13	.13	.13	.13	.13	.13	.....
Lard Oil, prime	.90	.90	.90	.90	.90	.90	.....
Lead, 100 lbs.	3.80	3.80	3.80	3.80	3.80	3.80	.....
Linseed Oil	.47	.47	.47	.47	.47	.47	.....
Open-Hearth Steel, ton	18.00	18.00	18.00	18.00	18.00	18.00	.....
Petroleum, bbl., Kans., crude	.55	.55	.55	.55	.55	.55	.....
Petroleum, bbl., Pa., crude	1.45	1.45	1.45	1.45	1.45	1.45	.....
Rapeseed Oil, refined	.71	.71	.71	.71	.71	.72	+.01
Rubber, Fine Up-River, Para	.70	.70	.70	.70	.72	.71	+.01
Silk, raw, Ital	..	3.90	..	..	3.90	3.90	.....
Silk, raw, Japan	..	3.13	..	..	3.12½	3.15	+.02
Sulphuric Acid, 60 Baume	.90	.90	.90	.90	.90	.90	.....
Tin, 100 lb.	33.00	33.50	33.60	33.50	32.75	32.75	—.25
Tire Scrap	.05	.05	.05	.05	.05	.05	.....

Race Dates for 1915

Contest Board of A. A. A. Reports 120 Sanctions for 1914—Official Records Announced

NEW YORK CITY, Dec. 4—At today's meeting of the Contest Board tentative dates for 1915 speed contests were allowed as follows:

Indianapolis Speedway	May 29
Galesburg, Ill., 200-miles	June 16
Sioux City Speedway	June 25
Tacoma Road Race	July 4
Elgin Races	August 20 and 21

Applications were made for dates from the recently organized Minneapolis Speedway, also the Sheepshead Bay Speedway promoters and the Detroit speedway, but owing to construction not having started on some of these no consideration was given the dates.

The official summary of sanctions issued by the Contest Board for the present year shows a total of 120 as compared with 101 last year, 132 in 1912, 117 in 1911, and 166 in 1910. In the last 5 years 1910 stood first in the contest field, 1912 was next, followed by 1914. The two poorest years were 1911 and 1913.

A further analysis of the 120 sanctions issued this year show that fifty-two were on 1-2-mile dirt tracks, thirty-six on 1-mile dirt tracks, ten were road races, eight reliability tests, two hill-climbs, four certified trials, and one each of beach races, commercial vehicle tests. Sanctions were issued to two speedways during the year, Indianapolis and Sioux City.

Many records made on speedways and tracks for the year were allowed, these including Indianapolis speedway records up to 500 miles made on May 30. Oldfield in the Stutz gets two of these marks, namely 20 and 25 miles, and all of the others above this go to the foreign cars. Other records were granted including 15 miles, 20 miles, 25 miles, and 75 miles to Burman on 1-mile dirt tracks, and 100 miles to Alley on a dirt track.

The annual statement of the Contest Board showed total receipts of $16,777.51, as against total expenses of $10,688.10, leaving a surplus for the year of slightly over $6,000. The receipts were from five sources, namely, sanction fees, drivers' registration fees, track licenses, fines and appeals. The sanction fees totaled $13,640 and the fees from the registration of drivers, $2,257.

Following are the claims for records:

CLAIMS FOR RECORDS

SPEEDWAY RECORDS, REGARDLESS OF CLASS

Distance	Time	Driver	Car	Place	Date
20 miles	13:58:14	Oldfield	Stutz	Indianapolis	May 30, 1914
25 "	17:30:40	Oldfield	Stutz	Indianapolis	May 30, 1914
50 "	33:45:32	Christiaens	Excelsior	Indianapolis	May 30, 1914
75 "	50:21:24	Christiaens	Excelsior	Indianapolis	May 30, 1914
100 "	1:10:46:50	Duray	Peugeot	Indianapolis	May 30, 1914
150 "	1:46:20	Duray	Peugeot	Indianapolis	May 30, 1914
200 "	2:25:11	Duray	Peugeot	Indianapolis	May 30, 1914
250 "	3:00:58.48	Thomas	Delage	Indianapolis	May 30, 1914
300 "	3:38:29.59	Thomas	Delage	Indianapolis	May 30, 1914
350 "	4:15:22.69	Boillot	Peugeot	Indianapolis	May 30, 1914
400 "	4:52:02.10	Thomas	Delage	Indianapolis	May 30, 1914
450 "	5:27:33.50	Thomas	Delage	Indianapolis	May 30, 1914
500 "	6:03:45.94	Thomas	Delage	Indianapolis	May 30, 1914

ONE MILE CIRCULAR DIRT TRACK RECORDS

15 miles	12:47:00	Burman	Peugeot	Peoria, Ill.	Sept. 12, 1914
20 "	17:10:60	Burman	Peugeot	Springfield, Ill.	Sept. 19, 1914
25 "	21:37:60	Burman	Peugeot	Springfield, Ill.	Sept. 19, 1914
75 "	1:08:56:00	Burman	Peugeot	Galesburg, Ill.	Oct. 22, 1914
100 "	1:31:30:00	Alley	Duesenberg	Hamline, Minn.	Oct. 24, 1914

The official record sheet of the contest board has been issued under date of November 4, 1914. The records listed are:

OFFICIAL RECORDS ALLOWED AND ACCEPTED BY A. A. A. CONTEST BOARD

STRAIGHTAWAY FREE-FOR-ALL RECORDS, REGARDLESS OF CLASS

Distance	Time	Driver	Car	Place	Date
1 kilo	15.88	Burman	Blitzen-Benz	Daytona	Apr. 23, 1911
1 mile	25.40	Burman	Blitzen-Benz	Daytona	Apr. 23, 1911
2 miles	51.28	Burman	Blitzen-Benz	Daytona	Apr. 23, 1911
5 "	2:34	Hemery	Darracq	Daytona	Jan. 24, 1906
10 "	5:14.40	Bruce-Brown	Benz	Daytona	Mar. 24, 1909
15 "	10:00	Lancia	Fiat	Daytona	Jan. 29, 1906
20 "	13:11.92	Burman	Buick Bug	Jacksonville	Mar. 30, 1911
50 "	35:52.31	Burman	Buick Bug	Jacksonville	Mar. 28, 1911
100 miles	1:12:45.20	Bernin	Renault	Daytona	Mar. 6, 1908
150 "	1:55:18	Disbrow	Special	Jacksonville	Mar. 31, 1911
200 "	2:34:12	Disbrow	Special	Jacksonville	Mar. 31, 1911
250 "	3:14:55	Disbrow	Special	Jacksonville	Mar. 31, 1911
300 "	3:53:33.50	Disbrow	Special	Jacksonville	Mar. 31, 1911
81.65 "	One Hour	Disbrow	Special	Jacksonville	Mar. 28, 1911

(Standing Start)

1 mile	40.53	Oldfield	Benz	Daytona	Mar. 16, 1910

CLASS "B" STOCK CHASSIS STRAIGHTAWAY RECORDS

161 TO 230 CUBIC INCHES

5 miles	4:24.13	Towers	Warren-Detroit	Jacksonville	Mar. 29, 1911
10 "	9:10.52	Towers	Warren-Detroit	Jacksonville	Mar. 30, 1911

231 TO 300 CUBIC INCHES

10 miles	8:16.35	Wilson	Cole	Jacksonville	Mar. 29, 1911

301 TO 450 CUBIC INCHES

1 kilo	26.75	Mers	National	Jacksonville	Mar. 29, 1911
1 mile	40.32	Wilcox	National	Jacksonville	Mar. 30, 1911
5 miles	3:56.82	Wilcox	National	Jacksonville	Mar. 30, 1911
10 "	8:03.67	Mers	National	Jacksonville	Mar. 29, 1911

SPEEDWAY RECORDS, REGARDLESS OF CLASS

¼ mile	8.16	Burman	Blitzen-Benz	Indianapolis	May 29, 1911
½ "	16.80	Burman	Blitzen-Benz	Indianapolis	May 29, 1911
1 kilo	21.40	Burman	Blitzen-Benz	Indianapolis	May 29, 1911
1 mile	35.35	Burman	Blitzen-Benz	Indianapolis	May 29, 1911
2 miles	1:15.96	Bragg	Fiat	Los Angeles	Apr. 13, 1910
3 "	1:54:83	Bragg	Fiat	Los Angeles	May 5, 1912
4 "	2:33:37	Bragg	Fiat	Los Angeles	May 5, 1912
5 "	3:11:75	Bragg	Fiat	Los Angeles	May 5, 1912
10 "	6:35.62	Robertson	Simplex	Los Angeles	Apr. 9, 1910
15 "	10:25.17	Hearne	Benz	Indianapolis	July 4, 1910
20 "	13:58.14	Oldfield	Stutz	Indianapolis	May 30, 1914
25 "	17:30.40	Oldfield	Stutz	Indianapolis	May 30, 1914
50 "	33:45.32	Christiaens	Excelsior	Indianapolis	May 30, 1914
75 "	50:21.24	Christiaens	Excelsior	Indianapolis	May 30, 1914
100 "	1:10:46.50	Duray	Peugeot	Indianapolis	May 30, 1914
150 "	1:46:20	Duray	Peugeot	Indianapolis	May 30, 1914
200 "	2:25:11	Duray	Peugeot	Indianapolis	May 30, 1914
250 "	3:00:58.48	Thomas	Delage	Indianapolis	May 30, 1914
300 "	3:38:29.59	Thomas	Delage	Indianapolis	May 30, 1914
350 "	4:15:22.69	Boillot	Peugeot	Indianapolis	May 30, 1914
400 "	4:52:02.10	Thomas	Delage	Indianapolis	May 30, 1914
450 "	5:27:33.50	Thomas	Delage	Indianapolis	May 30, 1914
500 "	6:03:45.94	Thomas	Delage	Indianapolis	May 30, 1914

(Hour Records)

74 miles	1:00:00	Harroun	Marmon	Los Angeles	Apr. 16, 1910
148 "	2:00:00	Harroun	Marmon	Los Angeles	Apr. 16, 1910

ONE MILE CIRCULAR DIRT TRACK RECORDS

1 mile	46.20	Disbrow	Simplex	St. Louis, Mo.	Aug. 8, 1914
2 miles	1:32.60	Disbrow	Simplex	St. Louis, Mo.	Aug. 8, 1914
3 "	2:27.81	Disbrow	Simplex	Cleveland, O.	Sept. 14, 1912
4 "	3:17.02	Disbrow	Simplex	Cleveland, O.	Sept. 14, 1912
5 "	4:06.58	Disbrow	Simplex	Cleveland, O.	Sept. 14, 1912
10 "	8:17.02	Disbrow	Simplex	Cleveland, O.	Sept. 14, 1912
15 "	12:47.00	Burman	Peugeot	Peoria, Ill.	Sept. 12, 1914
20 "	17:10.60	Burman	Peugeot	Springfield, Ill.	Sept. 19, 1914
25 "	21:37.60	Burman	Peugeot	Springfield, Ill.	Sept. 19, 1914
50 "	45:32:00	Disbrow	Simplex	Detroit, Mich.	Sept. 29, 1912
75 "	1:08:56.00	Burman	Peugeot	Galesburg, Ill.	Oct. 22, 1914
100 "	1:31:30.00	Alley	Duesenberg	Hamline, Minn	Oct. 24, 1914
150 "	2:30:51.00	Wishart	Mercer	Columbus, O.	Aug. 25, 1912
200 "	3:21:48:00	Mulford	Mason Special	Columbus, O.	July 4, 1913

CLASS "B" SPEEDWAY RECORDS STOCK CHASSIS

451 TO 600 CUBIC INCHES

5 miles	4:01.36	Oldfield	Knox	Indianapolis	May 30, 1910
10 "	7:47.71	Robertson	Fiat	Atlanta	Nov. 11, 1909
20 "	15:57.41	De Palma	Fiat	Atlanta	May 5, 1910
50 "	42:02.98	Robertson	Fiat	Atlanta	Nov. 13, 1909
100 "	1:22:35.35	Robertson	Fiat	Atlanta	Nov. 13, 1909
150 "	2:05:00.63	Robertson	Fiat	Atlanta	Nov. 13, 1909
200 "	2:53:48.32	Disbrow	Rainier	Atlanta	Nov. 13, 1909

301 TO 450 CUBIC INCHES

5 miles	4:05.76	Kincaid	National	Indianapolis	May 27, 1910
10 "	7:55.12	Aitken	National	Indianapolis	July 2, 1910
15 "	11:48.78	Aitken	National	Indianapolis	July 1, 1910
20 "	15:57.63	Dawson	Marmon	Indianapolis	May 27, 1910
50 "	39:47.35	Dawson	Marmon	Atlanta	Nov. 3, 1910
75 "	1:00:16.34	Dawson	Marmon	Indianapolis	May 27, 1910
100 "	1:23:43.11	Kincaid	National	Indianapolis	May 27, 1910
150 "	2:05:02.17	Chevrolet	Buick	Atlanta	Nov. 9, 1909
200 "	2:46:48.47	Chevrolet	Buick	Atlanta	Nov. 9, 1909
250 "	4:38:57.40	Burman	Buick	Indianapolis	Aug. 19, 1909

231 TO 300 CUBIC INCHES

5 miles	4:16.00	Dawson	Marmon	Indianapolis	July 2, 1910
10 "	8:16.08	Harroun	Marmon	Indianapolis	May 27, 1910
20 "	17:10.70	Chevrolet	Buick	Atlanta	Nov. 11, 1909
25 "	21:48.92	Harroun	Marmon	Indianapolis	May 30, 1910
50 "	42:41.33	Harroun	Marmon	Indianapolis	May 30, 1910
75 "	67:31.07	Harroun	Marmon	Atlanta	Nov. 11, 1909
100 "	1:30:08.31	Harroun	Marmon	Atlanta	Nov. 11, 1909

161 TO 230 CUBIC INCHES

4 miles	3:49.00	Witt	E. M. F.	Atlanta	Nov. 3, 1910
5 "	4:35.47	L. Chevrolet	Buick	Indianapolis	July 2, 1910
10 "	8:55.40	L. Chevrolet	Buick	Indianapolis	July 2, 1910
20 "	19:51.00	Knipper	Chalmers	Atlanta	Nov. 12, 1909
50 "	50:36.00	Nelson	Buick	Atlanta	Nov. 9, 1909
100 "	1:40:46.81	Knipper	Chalmers	Atlanta	Nov. 10, 1909

160 CUBIC INCHES AND UNDER

1 mile	0:56.80	Witt	Flanders	Indianapolis	Nov. 13, 1911
5 miles	4:22.98	Witt	Flanders	Indianapolis	Nov. 13, 1911
10 "	9:27.49	Witt	Flanders	Indianapolis	Nov. 13, 1911
15 "	14:13.26	Witt	Flanders	Indianapolis	Nov. 13, 1911
20 "	19:00.87	Witt	Flanders	Indianapolis	Nov. 13, 1911

CLASS "C" SPEEDWAY RECORDS

160 CUBIC INCHES AND UNDER

5 miles	4:26.08	Evans	Flanders	Indianapolis	Nov. 13, 1911
10 "	8:53.97	Evans	Flanders	Indianapolis	Nov. 13, 1911
15 "	13,24.00	Evans	Flanders	Indianapolis	Nov. 13, 1911
20 "	17:54.82	Evans	Flanders	Indianapolis	Nov. 13, 1911

161 TO 230 CUBIC INCHES

5 miles	4:20.20	J. Nikrent	Buick	Los Angeles	Apr. 15, 1910
10 "	8:40.17	J. Nikrent	Buick	Los Angeles	Apr. 15, 1910
15 "	13:14.52	J. Nikrent	Buick	Los Angeles	Apr. 9, 1910
20 "	17:37.36	J. Nikrent	Buick	Los Angeles	Apr. 9, 1910
25 "	21:12:42	Tower	Flanders Special	Los Angeles	May 5, 1912
50 "	43:49.69	Endicott	Cole	Los Angeles	Apr. 9, 1910

231 TO 300 CUBIC INCHES

1 mile	0:45:60	De Palma	Mercer	Los Angeles	May 5, 1912
2 miles	1:31:53	De Palma	Mercer	Los Angeles	May 5, 1912
3 "	2:17:17	De Palma	Mercer	Los Angeles	May 5, 1912
4 "	3:02:70	De Palma	Mercer	Los Angeles	May 5, 1912
5 "	3:47:34	De Palma	Mercer	Los Angeles	May 5, 1912
10 "	7:27:33	De Palma	Mercer	Los Angeles	May 5, 1912
15 "	11:11:17	De Palma	Mercer	Los Angeles	May 5, 1912
20 "	14:56:05	De Palma	Mercer	Los Angeles	May 5, 1912
25 miles	18:53:20	J. Nikrent	Case	Los Angeles	May 5, 1912
50 "	42:30.08	Siefert	Dorris	Los Angeles	Apr. 8, 1910
75 "	1:03:54.28	Harroun	Marmon	Los Angeles	Apr. 8, 1910
100 "	1:25:22.07	Harroun	Marmon	Los Angeles	Apr. 8, 1910

301 TO 450 CUBIC INCHES

5 miles	3:49.36	J. Nikrent	Buick	Los Angeles	Apr. 17, 1910
10 "	7:36.61	J. Nikrent	Buick	Los Angeles	Apr. 17, 1910
15 "	12:04.99	Dawson	Marmon	Los Angeles	Apr. 15, 1910
20 "	16:04.40	Harroun	Marmon	Los Angeles	Apr. 15, 1910
25 "	20:08.69	Harroun	Marmon	Los Angeles	Apr. 15, 1910
50 "	39:53.55	Harroun	Marmon	Los Angeles	Apr. 15, 1910

451 TO 600 CUBIC INCHES

5 miles	3:38.61	Oldfield	Knox	Los Angeles	Apr. 16, 1910
10 "	7:20.66	Oldfield	Knox	Los Angeles	Apr. 16, 1910
15 "	11:32.34	Marquis	Isotta	Los Angeles	Apr. 10, 1910
20 "	15:29.18	Marquis	Isotta	Los Angeles	Apr. 10, 1910
25 "	19:24.92	Marquis	Isotta	Los Angeles	Apr. 10, 1910
50 "	39:20.69	Marquis	Isotta	Los Angeles	Apr. 10, 1910

24-HOUR TRACK RACES

Stock Chassis	Lozier	Patschke & Mulford	1,196 miles	Brighton Beach	Oct. 15, 1909
Cl. "C"	Stearns	Poole & Patschke	1,253 miles	Brighton Beach	Oct. 19, 1910
Cl. "C" Spdwy	Fiat	Verbeck & Hirsh	1,491 miles	Los Angeles	Apr. 8, 1911

San Diego To Have $10,000 Race

LOS ANGELES, CAL., Dec. 3—The entry blanks for the San Diego Exposition Road Race which is scheduled for January 9, were distributed today. The event is to be conducted under the auspices of the Al Bahr Temple, Mystic Shrine, San Diego, under official A. A. A. Sanction No. 786. The event is to be managed by A. M. Young of this city who managed the recent Corona road race.

The San Diego event is to be run over the spectacular Point Loma course which measures 5.982 miles to the circuit. The total distance for the race is 305.082 miles or 51 laps. There is to be but one event, the Class "D" non-stock free-for-all. The entry fee is $150 and $10,000 in cash prizes is to be awarded, with an additional $2,500 for a new world's record for a distance not less than 300 miles.

While no entries have been officially announced, the management stated today that it was practically assured that all the drivers who appeared at the Corona speed meet, would drive at San Diego and later go north to compete in the Vanderbilt and Grand Prix at San Francisco in February.

Earl Cooper left for the East yesterday in company with Fred J. Wagner, but is to return in time for the San Diego meet. Bob Burman is in Los Angeles, but Ed. Rickenbacher has gone to New York for parts for the Peugeot cars which were disabled at Corona.

Harry Grant and Harry Babcock with the two Sunbeams are repairing the machine which was wrecked by fire in the Corona race and Grant stated today that he believed the car would be ready for the San Diego race.

The Duesenberg team is still here and wil lenter the next California race.

Barney Oldfield is reported to be signed to drive a Maxwell at San Diego, but the veteran driver says that he will not know what car he will drive or if he will drive at San Diego at al lor not, until the practice starts on the Point Loma course, January 2, the day after the exposition opens.

Eddie Pullen went north to look over the San Francisco course today and said it was probable that he would pilot the Mercer at San Diego, although there was nothing certain.

The Stutz trio is to be in the race and the entries are to be filed early next week, according to the race management.

Ralph De Palma has returned to the East but is to be back for the San Diego event according to close friends here.

Race Course for San Bernardino

SAN BERNARDINO, CAL., Dec. 3—A 10-mile motor race course around Perris Hill, just north of this city, is being seriously considered by San Bernardino capitalists and automobile enthusiasts. The project has been placed before the local Chamber of Commerce and the Board of Supervisors and it is probable that construction will be commenced within a short time.

The proposition is being backed by Charles Rouse and John Anderson of this city. Anderson is the local representative for the Western Automobile Assn.

Haynes Six on 100-Mile Low Gear Test

NEWARK, N. J., Dec. 5—A severe test of the ability of the Haynes light six to stand the continuous use of the low gear was made on Friday, December 4, when a demonstrating car was given an all-day low-gear run by Clarence R. Schuyler, manager of the Haynes branch in Newark, N. J. The total distance covered was 180.4 miles, of which 166.1 miles were covered without stopping the motor. A stoppage in the 15th mile due to a clogged gasoline line was the only untoward incident of the trip.

The car was driven 100 miles, non-stop, in 6 hours 52 minutes, and the distance for 10 hours running was 151.2 miles, a little better than 15 miles an hour. The consumption of gasoline for the whole 180.4 miles was 23 gallons, 7.8 miles to the gallon, and the oil used was 7 quarts, 25.7 miles per quart. No water was added to the cooling system and the car returned at the end of the run with the radiator practically as full as when starting out; the actual drop of the water level was less than a quarter of an inch. A motometer showed that the temperature did not rise higher than 160 degrees Fahr. at any time; the average was about 115 degrees. The water did not boil at any time and the water jackets were not too hot to lay the bare hand on even at the tops of the worst of the many bad hills.

The touring car used was a stock model used as a demonstrator and had been run about 1,000 miles. It was loaded with full equipment and four passengers, and weighed en route, scaled 3,800 pounds with and 3,230 pounds without passengers. The low gear ratio is 11.75 to 1, intermediate 7 to 1 and high 4 to 1.

Two Sunbeams May Enter Indianapolis Race

INDIANAPOLIS, IND., Dec. 5—Despite the war, several European entries for the next Indianapolis 500-mile, May 29, already seem certain. Darius Resta, one of the best of the foreign pilots, has written the speedway management that he, together with either Jean Chassagne or K. Lee Guinness, expects to bring over a pair of Sunbeams that will guarantee some extremely fast competition.

All three of the drivers mentioned are ineligible for army service, and hence will have no trouble getting away. At present their only problem is to get the consent of Louis Coatalen, the Sunbeam designer, to the venture, which, however, they expect to do with little difficulty.

The cars are the ones which competed in the 1914 Grand Prix de France. Showing a piston displacement of approximately 276 cubic inches, they come well within the limits prescribed by the speedway management. They are capable of speeds up to 110 miles an hour.

Milwaukee Show, Jan. 8-14; 83 Exhibitors

MILWAUKEE, WIS., Dec. 8—The 1915 Milwaukee motor show, January 8 to 14, will occupy by far the largest area of any of the six expositions that have preceded it. The show committee of the Milwaukee Automobile Dealers' Assn. has arranged for the use of 51,750 square feet of floorspace in the Milwaukee Auditorium, the leases calling for the entire main arena, Juneau, Kilbourn and Walker halls, the main arena basement, north and south rest rooms and the entire corridors around the arena. Eighty-three firms will exhibit.

COLUMBUS, O., Dec. 8—The annual Columbus Automobile Show which will be held in the Memorial Hall the week starting January 30 will be under the auspices of the Columbus Automobile Club and the Columbus Auto Trades Assn. The joint committee in charge of the show consists of J. P. Gordon, chairman, Ira Madden, vice-chairman; E. B. Coats, secretary; L. M. Browne, treasurer, and M. A. Pixley. In all fifty-five different cars will be shown including electric and gasoline passenger cars and motor trucks. Accessories will be displayed in the balcony.

28 More Exhibitors for National Shows

3 Car Makers and 25 Accessory Firms Added—Decoration Plans Are Complete

NEW YORK CITY, Dec. 8—The names of three makers of cars and twenty-five makers of accessories have been added to the already long line of exhibitors for the National shows in New York and Chicago. Of the car makers, only the Remington Motor Co. will exhibit at both shows, the other two will exhibit at Chicago only. The complete list is given herewith.

The work of decorating Grand Central Palace for the Fifteenth Annual National Automobile Show to be held January 2 to 9, began this week.

The dominant colors will be white, gold and crimson. As usual, the signs at each booth will contain merely the name of the car, and these will be uniform throughout. In the accessory department, the signs will contain the name of the exhibitor. More than 200 men are engaged in painting the signs, building the pillars and casts, and arranging the floral decorations.

Manager S. A. Miles plans to have the setting for the cars in the Coliseum and Armory in Chicago one of the most ornate ever devised for an automobile show in Chicago. An old English garden will be the theme of decorations at the Coliseum and no detail of the effect will be overlooked.

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New Overman Tire Company Is Organized

NEW YORK CITY, Dec. 8—The Overman Cushion Tire Co., New York City, with $150,000 capitalization, has been formed to succeed the Overman Tire Co., which is in the hands of receivers. The officers of the new company are: President, C. A. Taussig, an attorney; vice-president and sales manager, J. B. Bleiler, formerly an Overman salesman; treasurer and general manager, Max C. Overman, founder of the defunct company; secretary, Alexander Clogher. The company will discontinue the pneumatic tire with which it supplemented its cushion tire and will manufacture the cushion type only. The old company's factory in Passaic, N. J., has been discontinued and the new company is working temporarily in Belleville, N. J., with a New York office and store rooms at 250 West Fifty-fourth street.

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DETROIT, MICH., Dec. 4—The first meeting of creditors of the bankrupt Detroit Electric Appliance Co., was held yesterday at the office of referee in bankruptcy Lee E. Joslyn. The inventory of the defunct concern was made public and shows that according to the books of the company the assets are worth $324,967.94 while according to the Detroit Trust Co., receiver, the value of the assets is only $168,015.72. The liabilities are shown by the bankrupt company to be $324,-967.94 while the Detroit Trust Co. has placed them at $90,-957.19. According to three special appraisers the tangible assets are valued at $35,207.

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Premier Assets $307,376.50—Liabilities $508,468.52

INDIANAPOLIS, IND., Dec. 7—Frank E. Smith, receiver, has filed with Albert Rabb, referee in bankruptcy, a statement of the assets and liabilities of the Premier Motor Mfg. Co. The report is a voluminous one, covering about 100 typewritten pages and goes into the most minute detail.

According to the report, the total liabilities are $508,468.52 and the total assets $307,376.50. The plant is being operated, under direction of the United States Court and the receiver has been doing a very satisfactory business.

The liabilities include unpaid wages amounting to $5,774.77; priority debts amounting to $13,846.96; secured debts amounting to $809,062.54 and unsecured debts amounting to $160,048.84. The Fletcher American National Bank of this city holds contingent notes amounting to $107,047.68, secured by unsold cars which the receiver estimates are worth $82,137.50.

The assets include real estate valued at $50,050. The receiver does not state at what value he holds the patents and copyrights. The remainder of the assets include sums due from agents and officers of the company and due from other sources.

The receiver has paid all current wages due since he has been operating the plant. The item of unpaid salaries and wages mentioned was contracted before the receiver was appointed.

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CINCINNATI, O., Dec. 5—Edgar Daniels, doing business as "The Multi-Letter Shop," and the "Daniels Auto Supply Company," at Dayton, O., Saturday filed a petition of voluntary bankruptcy in the United States Court at Cincinnati. He has liabilities of $3,596.55 and assets of $2,883.94, of which he claims $500 exempt. His assets consist of stock in trade, $655; fixtures, etc., $809; debts due on open accounts, $343, and vehicles, $75.

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INDIANAPOLIS, IND., Dec. 8—Adrian Hamersly, president, has brought suit in the superior court at Indianapolis asking the appointment of a receiver for the Hassler Shock Absorber Sales Co. on the ground that the concern is insolvent and owes him $1,435.90.

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NEW YORK CITY, Dec. 9—Smith-Haines, dealers in automobile supplies in this city, at 176 Broadway, have assigned for the benefit of creditors to H. B. Wilson, Jr., H. S. Hechheimer and Elmer Engield. The firm is composed of D. R. Smith, F. A. Haines and Frederick Ray.

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LISBON, O., Dec. 5—Charging that the East Palestine Rubber Co. is on the verge of insolvency and in imminent danger of becoming wholly insolvent through mismanagement, A. E. Burnett has filed an action in the common pleas court here asking that a receiver be appointed by the court to protect and manage the property of the company. The company manufactures automobile tires.

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XENIA, O., Dec. 5—The Hawkins Cyclecar Co., has filed in the Common Pleas Court a dissolution suit, claiming that the purpose of the corporation had failed, in so much that it had been unable to sell a manufactured product.

In compliance with the law, which requires that 3 months elapse between the time of the petitions and the hearing, the date of the trial was set for February 27. W. L. McAllister was appointed by the court as Master Petitioner, to hear complaints and receive claims against the company.

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Blomstrom Receiver Is Awarded $46,106.75

DETROIT, MICH., Dec. 5—A suit for alleged breach of contract yesterday ended in the Circuit Court in the awarding of $46,106.75 to Julian G. Dickinson, receiver for the defunct Blomstrom Mfg. Co., against Fred Postal, owner of the Griswold Hotel, Detroit, and against Henry Bowen, a business man of Saginaw, Mich.

The complaint of the receiver against Postal and Bowen was that they had agreed in 1909 to take over the assets of the Blomstrom concern and to form a new company to be known as the Lion Motor Car Co. All the gyroscope motors made by the Blomstrom company were to be taken over by the new concern but it is charged that this was not done by the new company which made another type of motor car.

The stockholders of the Blomstrom company were to receive stock to the full value in the Lion company. After the incorporation of the Lion Motor Car Co., it is alleged that Postal and Bowen did not keep their contract.

During the present trial which lasted about 1 week the gyroscope motor was tested before the court and the jury.

Additional Exhibitors of Cars and Accessories for New York and Chicago Shows

Cars

Remington Motor Co.....New York, N. Y.
Ogren Motor Car Co.....Chicago, Ill.
Vulcan Mfg. Co.....Painesville, O.

Accessories—New York and Chicago

Hayes Mfg. Co.....Detroit, Mich.
Leece-Neville Co.....Cleveland, O.
Western Tire & Rubber Co..Kansas City, Mo.
Victor Lamp Co.....Cincinnati, O.
Voorhees Rubber Mfg. Co..Jersey City, N. J.

Accessories—Chicago Only

Hunter Auto Supply Co.....Chicago, Ill.
So-Sha-Belle Co.....Los Angeles, Cal.
Simplex Short Turn Gear Co..Anderson, Ind.
Right Motor Specialties Co.....Chicago, Ill.
H & D Co., Inc.....Goodland, Ind.
Cutting & Smith Sales Co.....Detroit, Mich.
Vanguard Mfg. Co.....Detroit, Mich.

Accessories—New York Only

Sipp Machine Co.....Paterson, N. J.
K-T Lever Spring Co.....New York
Max Machine Co.....Clinton, Mass.
M. L. Dunham.....New York
Motor Parts Co.....Philadelphia, Pa.
Woodbridge Chemical Co.....New York
Clincher Tire Plow Co.....New York
Mezzatesta & Fortier Co.....Brooklyn, N. Y.
E. U. Scoville Co.....Manlius, N. Y.
Dayton Rubber Mfg. Co.....New York
Clarence N. Peacock Co.....New York
National Oil & Supply Co.....Newark, N. J.
Wasson Piston Ring Co.....Hoboken, N. J.

Factory Miscellany

POPE Rents 13,000 Sq. Ft. Factory Space—Colonel George Pope, receiver of the Pope Mfg. Co. in the Connecticut jurisdiction, has rented the top floor of the Capitol avenue factory, Hartford, Conn., comprising about 13,000 square feet of floor space, to the Smith-Worthington Co., that city. The Smith-Worthington Co. is engaged in the manufacture of harnesses and saddles, and that this concern should need space in the Pope Building is explained by the fact that large orders for saddles, presumably from powers at war in Europe, have been received. For a long time past there have been various rumors as to the outcome of the property, part of which is now occupied by the Hartford Motor Car Co., the prime movers of which are Charles E. and Wilbur C. Walker, both former officers of the Pope company, who purchased of the receiver the parts making rights. Early this week it was stated that the Pratt & Whitney Co., a subsidiary of the Niles, Bement & Pond combination, wanted to rent a portion of the Pope factory. However, nothing came of the matter. The Pratt & Whitney company is now working off big orders for the Chinese, English and Russian governments, and needs room badly. Arthur L. Shipman, counsel for Receiver Pope, said this week that an offer to lease the factory had been made some time ago, the lease to run from 1½ to 2 years, but because the Pope real estate must be sold to satisfy creditors the counsel said that the offer had been turned down. The impression becomes the stronger from day to day that the Pope factories will eventually be acquired by some of Hartford's prosperous industries. It would not be at all surprising if the Pratt & Whitney company secured the property, as it adjoins their present big works.

New Bergdoll Plant in Trenton—The Bergdoll Automobile Co., Philadelphia, will erect a large manufacturing plant at Trenton Junction, N. J., near there.

Milwaukee Plant Suffers Fire Loss—The plant of the American Metal Products Co., 3102 Lisbon avenue, Milwaukee, Wis., was damaged $10,000 by fire on November 28. Arrangements are being made to resume production at once.

New Transmission Co.—J. G. Williams, of Trenton, Mich., and W. D. Gould, of Detroit, Mich., were in Sandusky, Mich., recently, trying to interest local business men in a new concern which is to make automobile transmissions. The company is to be known as the Ideal Gear Transmission Co., and will locate there if sufficient capital is raised by local business men.

Big Engine Shipment for Australia—The Affiliated Manufacturers' Co., 602 Caswell block, Milwaukee, Wis., a large selling organization handling a diversified line of products, has received an order for $10,000 worth of gasoline engines for shipment to Australia. It marks the resumption of the company's foreign business, interrupted in July by the outbreak of the war.

Ford Benefits Far-Reaching—As a result of 10 months' operation of the Ford profit-sharing plan, employees of the automobile manufacturer have purchased, on contract, homes valued at $5,000,000, upon which they have made payments aggregating $1,200,000, have taken life insurance to the amount of $3,000,000 and have saved on an average of $48.76 per month each, which is either in savings banks or invested in real estate. About 9,200 employees are under the profit-sharing plan. More of them are coming up to the qualifications constantly. Since the plan went into effect the average gain per man in bank deposits has been 130 per cent; in life insurance, 86 per cent; in homes owned, 87 per cent. There is a marked increase in the number of naturalized citizens and a radical improvement in their habits, morals, health, mentality and living conditions.

Manufacture Sheet Metal Wiring Machines—The Magee Sheet Metal Machinery Co., Detroit, Mich., recently incorporated, is going to manufacture sheet metal wiring machines specially used in wiring fenders. Several sample machines have been tried out by one of the largest automobile manufacturers, and it is stated, have resulted in the saving of more than $40 a day through their use. The new machine will run 1,750 feet of wire during a 9-hours working day, wiring 250 fenders of the particular type used on the cars made by that manufacturer. Where the cost had been 6 cents for wiring the fenders of those cars according to the old method, the new machine has brought this cost down to 1 1-2 cents. Another advantage of the Magee machine is that it requires but a rather small floorspace, one man operating the machine within a space of 16 square feet, it is claimed. For the time being the machines will be made only per contract and later a factory will be built.

The Automobile Calendar

Dec. 12-19.....Akron, O., Show, Akron Auto Show Co., O'Neill Bldg.
Dec. 14-18.....Chicago, Ill., American Good Roads Congress.
Jan. 2-9.....New York City, Annual Automobile Show, Grand Central Palace.
Jan. 2-9.....New York City, Automobile Salon, Grand Ball Room of Astor Hotel, Automobile Importers' Alliance, E. Lascaris, Pres.
Jan. 3-10.....Buenos-Aires, Argentina, Grand Prize of Argentina.
Jan. 5-7.....New York City, Engineering Societies' Bldg., Winter Meeting Society of Automobile Engineers.
Jan. 8-14.....Milwaukee, Wis., Show, Auditorium, Milwaukee Auto. Dealers' Assn.
Jan. 8-18.....Kansas City, Mo., Show.
Jan. 9.....San Diego, Cal., Road Race.
Jan. 9-16.....Philadelphia Show, Metropolitan Bldg., Philadelphia Auto. Trade Assn.
Jan. 16.....Detroit, Mich., Show.
Jan. 16-23.....Cleveland, O., Show, Cleveland Automobile Show Co., F. H. Caley, Mgr.
Jan. 23-30.....Montreal, Que., Show, Allen Line Liverpool Bldgs., Montreal Automobile Trade Assn., T. C. Kirby, Mgr.
Jan. 23-30.....Chicago, Ill., Automobile Show, Coliseum and First Regiment Armory.
Jan. 25-30.....Fall River, Mass., Show.
Jan. 25-30.....Buffalo, N. Y., Show, Broadway Auditorium, Buffalo Automobile Dealers' Assn.
Jan. 30-Feb. 6....Columbus, O., Show, Memorial Hall, Columbus Auto. Club and Columbus Auto. Trades Assn.
Jan. 30-Feb. 6....Minneapolis, Minn., Show, National Guard Armory, Minneapolis Automobile Trade Assn.
Feb.....Portland, Ore., Show, Portland Auto. Trade Assn.
Feb.....Toledo, O., Show, Toledo Auto Show Co.
Feb. 2-7.....Kalamazoo, Mich., Show, Armory.
Feb. 15.....Grand Rapids, Mich., Show, Klingman Furniture Exposition Bldg., Grand Rapids *Herald*, C. S. Merriman.
Feb. 15-20.....Omaha, Neb., Show, Auditorium, C. G. Powell.
Feb. 15-20.....Grand Rapids, Mich., Show, Klingman Bldg., Grand Rapids Herald.
Feb. 15-20.....Bridgeport, Conn., Show, State Armory, B. B. Sterber.
Feb. 22.....San Francisco, Cal., Vanderbilt Cup Race, Panama-Pacific Exposition Grounds; Promoter, Panama-Pacific Exposition Co.
Feb. 23-27.....Ft. Dodge, Ia., Show, Armory, C. W. Tremain, Sec.
Feb. 23-27.....Syracuse, N. Y., Show, Syracuse Auto Dealers' Assn.; H. T. Gardner, Mgr.
Feb. 27.....San Francisco, Cal., Panama-Pacific Exposition, Grand Prize Race, Panama - Pacific Exposition Grounds; Promoter, Panama-Pacific Exposition Co.
Mar. 6-13.....Boston, Mass., Show, Mechanics Bldg., Boston Auto Dealers Assn., Boston Commercial Motor Veh. Assn.
Mar. 9-15.....Des Moines, Ia., Show, C. G. Van Vliet.
Mar. 14.....San Francisco, Cal., Panama - Pacific Cup Race, Panama - Pacific Exposition Grounds; Promoter, Panama - Pacific Exposition Co.
April.....Calumet, Mich., Show, Coliseum.
May 29.....Indianapolis, Ind., 500-Mile Race, Indianapolis Motor Speedway.
June 16.....Galesburg, Ill., Two-mile Race-Track Meet.
June 25.....Sioux City, Ia., Track Meet.
July 4.....Tacoma, Wash., Road Race.
Aug. 20-21.....Elgin, Ill., Road Race.
Sept. 20-25.....San Francisco, Cal., International Engineering Congress.

The Week in the Industry

Motor Men in New Roles

FERGUSON Heads Grant-Lees Sales—Richard Ferguson has been placed in charge of the sales of the Grant-Lees Machine Co., Cleveland, O. He remains also as manager of the buying and production departments.

New Apperson Branch Manager—C. E. Wilbar has been appointed manager of the Pittsburgh, Pa., branch of the Apperson Bros. Automobile Co., Kokomo, Ind.

Burke Joins Gray and Davis—W. W. Burke, better known as "Billy Burke," has been appointed New York branch manager of the Gray and Davis Co., of Boston.

LeCain in Business—Jack LeCain has formed a company in Boston, Mass., to handle the Master carbureter and other specialties with headquarters on Massachusetts avenue.

Homan Representing Gould Battery—C. C. Homan, who was general purchasing agent of the Willys-Overland Co., Toledo, O., is now a special sales representative of the Detroit, Mich., department of the Gould Storage Battery Co.

Lurie Joins Colt-Stratton—Robert Lurie, for a number of years connected with the used car business along automobile row in New York City, has been made manager of the used car department of the Colt-Stratton Co., that city, with headquarters at 1770 Broadway.

Neel Heads Philadelphia Corp.—The following officers of the Automobile Sales Corp., Philadelphia, Pa., distributer of the Cadillac, were elected recently to serve for the ensuing year: President, P. L. Neel; vice-president, S. Stankovitch, Jr.; secretary, J. B. Dickson, and treasurer, H. R. Shock.

McLaughlin Sales Manager—E. J. McLaughlin, formerly sales manager of the Saxon Co., in New York territory, has been appointed general sales manager of the Hudson-Bender Motor Car Co., Kane, Pa., distributor of the Hudson in thirteen counties of Pennsylvania and three in New York State.

Studebaker Firestone's N. Y. Manager—C. D. Studebaker has been appointed manager of the New York City branch of the Firestone Tire & Rubber Co., Akron, O., succeeding J. J. Jordan, who goes to Europe to take charge of the Firestone company's European department and develop its foreign business.

Coates Heads Kalamazoo Assn.—At a meeting of the Kalamazoo Automobile Dealers' Assn., Kalamazoo, Mich., G. A. Coates, representative of the Haynes Co., was re-elected president; J. M. Van Loon, representative of the Cadillac Motor Car Co., was elected secretary, and William Harlow, of the Ford company, treasurer.

Huyette Re-elected Quaker Club Pres.—The ninth annual election for officers of the Quaker City Motor Club held in the Hotel Walton, Philadelphia, resulted in the re-election to the presidency of P. B. Huyette. In addition to Mr. Huyette, the following were the other successful candidates: Vice-presidents, G. D. Bartlett and A. H. Wetherill; treasurer, R. L. Murray, and secretary, W. E. Stagg.

Fisher's Standard Truck Appointment—The Standard Motor Truck Co., Detroit, Mich., announces the appointment of F. J. Fisher to the position of secretary-treasurer in place of W. K. Ackerman, who is no longer an official of the company. The other officers of the Standard company are Albert Fisher, president; U. A. Fisher, vice-president, and E. M. Elliott, general sales manager.

New Empire Manager—J. B. Todd, who has been connected with the Empire Rubber Co. for more than 7 years and for several years manager of its New York branch, at 240 West Fifty-fifth street, has severed his connection with the concern to take an important position with Marshall, Wood & Co., of Plattsburg, N. Y., dealer in automobile supplies and hardware. The new manager of the New York branch of the Empire Rubber Co. will be Thomas O'Callaghan, Jr.

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Garage and Dealers' Field

Philadelphia Overland Moves—The Overland Motor Co., Philadelphia, Pa., will shortly move to much larger quarters at 323-325-327 North Broad street and 1339-1347 Wood street.

Remy Service Station Changed—The Remy Electric Co. has changed its service station in Los Angeles, Cal. The station is now conducted by the Hucks Auto Electric Co., 627 West Pico street.

Williams Co. Equipping—The plant of Williams & Co., 58 Parks street, Niagara Falls, Ont., is to be equipped with machinery for the manufacture of carbureters and equipment for general garage and automobile repairs.

Represents Master Carbureter—The Drenco Machine Co., Inc., New York City, has taken on the Master carbureter and will represent it in the metropolitan district, taking in Northern New Jersey, Southern New York counties, Long Island and adjoining Connecticut territory.

Fifty Hours' Service Free—E. M. Holmes, an Indianapolis, Ind., dealer, is giving a coupon book good for 50 hours of service to each person buying a motor car through his agency. The coupons are good any time during the life of the car. Mr. Holmes is agent for the Detroiter and Monarch.

Flanders Moves in Detroit—The F. E. Castle Co., Detroit, Mich., factory representatives of Edmunds & Jones Mfg. Co., the Rands Mfg. Co. and recently appointed representative for the Paris Tire & Rubber Co., Newark, O., and the Sterling Spring Co., has moved into new offices and salesrooms at 872 Woodward avenue.

Diamond Establishes Wholesale Depot—A wholesale depot for the distribution of Diamond tires to dealers located in Washington, Oregon, Idaho, Montana and the Canadian provinces of British Columbia and Alberta has been established in Seattle. Heretofore this field has been supplied from the Diamond branch in San Francisco.

Cleveland's New Accessory Firm—The Fen-Kar Co. has been organized in Cleveland, O., by H. J. Farr, J. A. Fenner, C. W. Fenner and W. F. Martin, respectively president, secretary, treasurer and manager of the company. The firm has salesrooms at 2121 East Fourth street, and does a wholesale and retail automobile accessory business.

Regal Agent's Novel Advertising Scheme—H. P. Lorbach, the Regal agent at Circleville, O., has hit upon a novel advertising scheme which has brought a lot of publicity. He held a guessing contest on the number of beans in a jar, giving to the winner a certain credit on the amount of money required for a new car. One man guessed the exact number of beans in the jar.

McClurg to Make Tires—The McClurg Rubber Co., Coshocton, O., has been incorporated with a capital of $250,000 to manufacture automobile tires and tubes by J. S. McClurg, W. A. Himebaugh, O. D. Tucker, J. M. McClurg and William L. Davis. Plans are being made to take over the plant of the S. & M. Rubber Co. and start operations on a large scale by January 1.

Goodyear Moves to L. I. City—The Goodyear Rubber Tire Co., of New York, has moved its headquarters from Broadway and 67th street, New York City, to its big warehouse and service station in Long Island City. This building occupies a plot of 50 by 268 feet, and is six stories in height. The company sells only at wholesale, but will continue to maintain a stock of tires and a branch service in Manhattan.

Overland's Seattle Branch Adds—The J. W. Leavitt & Co., Seattle, Wash., Pacific coast distributors of Overland automobiles, states that two stories will be added to the corporation's plant in Seattle. The present home of the Leavitt company in Seattle provides 21,000 square feet of floor space, and, with the two additional stories, there will be available a total of 36,000 square feet of room. The improvement will cost upwards of $12,000 and will be completed by spring. The building will be of brick and steel. The two new floors will be devoted to the rebuilding and painting of used cars.

Bartles Oil's New Station—The Bartles independent oil interests have decided to establish a large distributing station at Ashland, Wis., to serve the vast Northwest Wisconsin territory. The Bartles-Dadmun Oil Co., capital stock $25,000, has been organized by C. A. Maguire, of Duluth and John Dadmun, of Milwaukee, and will spend from $10,000 to $15,000 in the erection of permanent offices, tanks, warehouse, etc. Mr. Dadmun will be active manager and move to Ashland. The Bartles associated companies now have stations and offices in Milwaukee, St. Paul, Peoria, Dayton, Waterloo, Ia.; Stillwater, Wilman, Minn.; Grand Forks and Beach, N. D., and Crookston, Minn.

STEWART Warning Signal—The Stewart hand-operated warning signal which is made by the Stewart-Warner Speedometer Corp., Chicago, Ill., has been reduced to $5. This horn, Fig. 1, is of substantial construction, and each gear is furnished with a steel bushing on which the bearings are carried. Lubrication is effected by means of an oil-soaked, felt pad which rubs against the bearings and wheels continuously. This signal has a double bracket so that the horn remains solid no matter how severe the pressure. The bracket is made with a swivel, one part of which fastens to the rail of the car and the other part holding the horn is swiveled on it so that the horn can be adjusted to suit. A high gearing is employed so that one full depression of the plunger produces 192 distinct sound impulses.

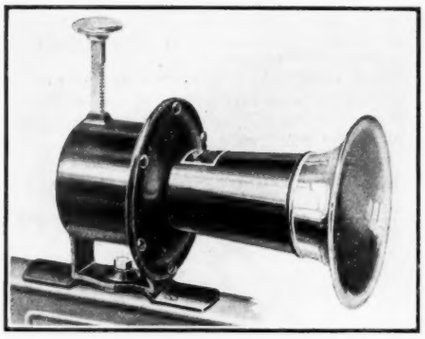

Fig. 1—Stewart warning signal selling for $5

C-C Shock Absorber—The Cox Brass Mfg. Co., Albany, N. Y., has bought out a new shock absorber for Fords to be sold at the unusually low price of $8 per set of four and $4.50 per pair.

The construction of the C-C is extremely simple—a slotted spring cage with two belt holes, through which the belts are run, displacing the Ford shackle belts, makes the attachment. Inside the spring cage, a sturdy helical spring of finely tempered steel carries the weight of the car, cushioning, softtening and smoothing out irregularities of the road. Inside the big spring—a smaller one—a compensating spring wound in the opposite direction, assists the main spring. A nut at the top enables one to adjust, at will, the C-C shock absorbers to meet the peculiarities of any Ford.

The action of the C-C is such that when the car receives an extremely severe jolt, the rebound is checked by means of a spur so designed that automatically the entire capacity of both springs is brought into action.

The C-C shock absorbers can be attached without removing the wheels. The Cox Company claim that these shock absorbers can be put on by any one in less than an hour.

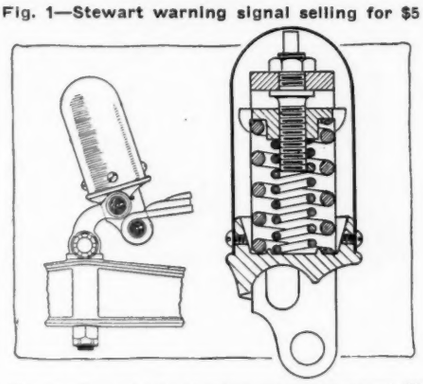

Fig. 2—Cox shock absorbers for Fords at $8 per sent of four

Johns-Manville Clocks—The H. W. Johns-Manville Company has just announced the addition of two new type clocks, Fig. 3, to their extensive line of automobile accessories, one for flush and one for dash board mounting, both embodying the latest approved ideas in clock construction in an 8-day fully-guaranteed time piece.

These clocks have been designed so that the mounting screws, winding keys and setting knobs are hidden from view and fully protected; therefore easily cleaned and practically proof against tampering.

The movement, which is of the lever escapement type, is enclosed in a dust, dirt and moisture proof case that is permanently secure to the clock bezel. This unit, in turn, is carried in an outer case and locked by a patented device that makes it possible to remove and replace same by a simple quarter-turn. Both winding key and setting knob are permanently attached to movement.

The purchaser of the J-M Automobile Clock has a choice of several finishes, in black with brass, nickel or gun metal flange, with either black figures on white porcelain or silver dial or with white figures and hand on black dial.

Kellog Turbine Muffler—Unlike the muffler now employed to silence the exhaust, the new Kellog turbine muffler, Fig. 4, not only destroys the explosive noise from the motor but materially helps the discharge of exhaust gases from the motor.

A simple turbine wheel A is mounted in the path of the exhaust. Just forward of this wheel is an opening or by-pass which leads to the center of the turbine wheel. The rapid turning of the turbine wheel caused by the exhaust of one explosion produces a powerful suction which helps suck out the exhaust gas of the next. In other words the turbine is a flywheel which tends to make the flow of exhaust gas even, smoothing out the high-pressure waves that occur at the instant when the exhaust valves open. A simple baffle plate B further muffles the exhaust.

The device is manufactured by the Kellog Mfg. Co., Rochester, N. Y.

Graphalloy Self-Lubricating Bushings—Bearings which do not require lubrication are made by the Graphite Metallizing Corp., Yonkers, N. Y. Graphalloy is a product consisting of graphite impregnated with a molten metal and may be used wherever the duty is light. Light duty bearings include fan, timer, magneto and pump bearings. The basic element of graphalloy is pure graphite and the object in adding metal to it is to solidify the product so that it may be machined into bearings or bushings of any desired form and which will have the requisite strength and durability. The standard bearing consists of solid graphite rods impregnated with a babbitt of special composition. This metal has adequate strength and a low coefficient of friction.

Four-in-One Auto Heater—A heater of the same type is made by the Auto Heater Co., of America, 1148 Bedford avenue, Brooklyn, N. Y. It is known as the Four-in-One Heater, and is made supplied with either one or two registers, as desired. With two, one is placed in the panel under the front seat and the other is put in the tonneau floor. The heat is regulated by a valve which is placed in the exhaust line and which diverts more or less of the heat into the heater. Connection between the valve and the heater is through a large diameter flexible piece of tubing and the coils are suitably covered by a metal grating.

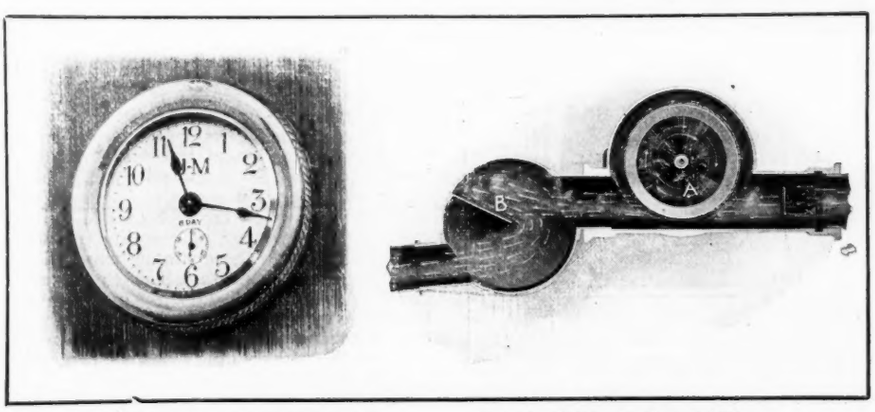

Fig. 3—J-M flush automobile clock

Fig. 4—Kellog turbine muffler

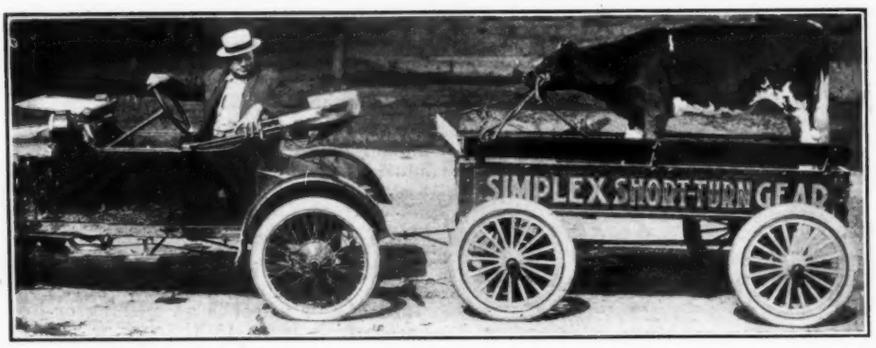

Fig. 5—Simplex trailer. The one illustrated is the 1,000-pound size

Dash Board Primer—The type of primer made by the Indiana Accessories Co., Indianapolis, Ind., consists merely of a tank on the dash which connects with the manifold by a small pipe, the flow of fuel being controlled by a small valve at the base of the tank. It is priced at $2.50 finished in nickel.

Simplex Trailer—A four-wheel trailer adapted to light cars and fitted with rubber tires has been brought out by the Simplex Short-Turn Gear Co., Indianapolis, Ind. It is made in tow capacities, 700 and 1,000 pounds.

The smaller one is fitted with solid tires and is designed for speeds of 20 miles per hour while the larger one is equipped with pneumatics and may be hauled at speeds up to 30 miles per hour. One-thousand-mile plain bearing axles are used on the smaller model and ball bearings are employed on the larger.

Carron Electrically Warmed Gloves—Gloves, Fig. 6, which incorporate in the lining a tough but flexible electrical circuit are made by Carron & Co., 75 Beekman street, New York City. This electrical circuit terminates on the surface of each forefinger in a small metal disk and at the thumb in a similar disk. When the hand grasps the wheel these small disks are brought into contact with the thin plates on the upper and under surfaces of the steering wheel which form the terminals of the wires from the storage battery. This circuit is closed by this contact and the current is led through the lining and across the back of the hand and all of the fingers. A 6-volt circuit is required.

Fuel Indicator—A device to tell the fuel consumed on a given trip and also the total amount of fuel used since the installation of the device is shown in Fig. 8. In other words this device bears the same relation to the measurement of the fuel that an odometer bears to the mileage covered. There is an indicating mechanism on the dash on which are two dials, one for trip consumption and the other for season.

With this device and the speedometer it is easily possible to figure the mileage per gallon on any trip or the mileage per gallon for the whole season.

It is stated that the construction of the device is simple, and is based on a principle that has been used with success on water meters. The device is made by the Fuel Meter Co., 937 East 54th street, Chicago, Ill.

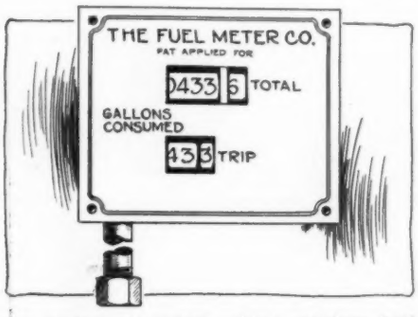

Fig. 8—Gasoline meter which registers both trip and season

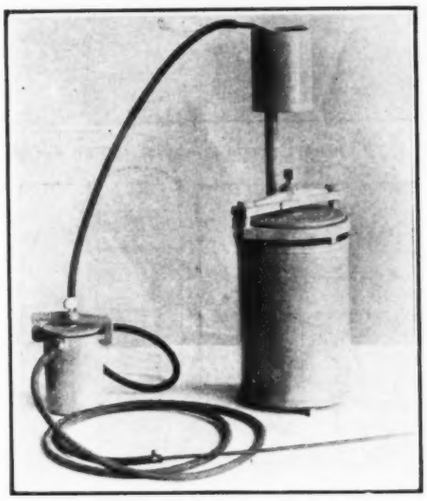

Fig. 7—Progressive carbon remover which generates its own gas

Progressive Carbon Remover—A complete oxygen-carbon removing outfit is manufactured for $7.50 by the Progressive Mfg. Co., Reading, Pa. It not only generates its own gas but forces it through a nozzle into the cylinders of the motor. The complete outfit is shown in Fig. 7. The main parts are a cylinder underneath which is an alcohol lamp. A special compound furnished with the outfit is placed in the cylinder and the alcohol lamp is lit. Then oxygen is generated and the gas passes to a water container where the oxygen is collected and then it is passed through another container where it is purified. From thence it is carried to the cylinders. The operation of burning out the carbon is done in the ordinary way. The cylinder is allowed to fill with oxygen and the carbon is lighted by a match or taper. Oxygen is supplied until the carbon is completely burned. It is wise to remove the spark plugs before the carbon is burned out because the heat may be sufficient to crack the porcelain although it is not enough to injure the motor. Additional compound may be obtained for 75 cents.

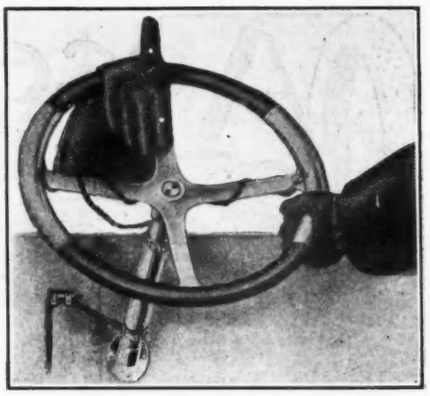

Fig. 6—Carron electrically heated gloves

Apex Oil Cup—Claiming that bearings which do not revolve cannot be lubricated properly by grease, the J. E. Lonegran Co., 211 Race street, Philadelphia, Pa., has brought out the oil cup shown in Fig. 9. The cup consists of a suitable shell which contains cotton waste for holding the oil. This shell is provided with a cap which has a filling slide so that lubrication may be easily effected. It is stated that one filling every 500 to 1,000 miles is sufficient. The rate of feed is regulated by the amount of waste in the cup. For instance, it is recommended that for spring bolts the cup be half filled. Three finishes, dull brass, finished brass and nickel are offered and the cups are made in .125 and .25-inch sizes. Prices vary from 50 to 80 cents.

Disfice Fibre Specialties—Many vulcanized fibre specialties suitable for motor car construction are made by the Diamond State Fibre Co., Elsmere, Del. Vulcanized fibre high-tension wiring cleats are made for wiring installations and wiring tubes both straight and curved are manufactured for housing wiring. It is stated that this material is oil-proof and can therefore be used for gaskets and washers. It may be used for speedometer gears thus reducing the noise and increasing the life of the parts. It is stated that the sheet fiber may be used in place of leather or sheet metal for fenders or even bodies and that it may be made into mud pans.

Jiffy Primer—The Crary Co., 650 Woodward avenue, Detroit, Mich., is manufacturing a motor primer under the name of Jiffy. It consists of a fuel tank which is mounted on the dash and which connects with the manifold through a small pipe. The flow of fuel is controlled by a small needle valve. It sells for $2.50.

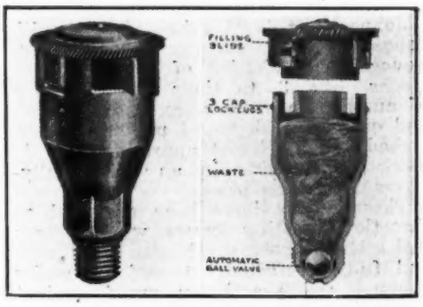

Fig. 9—Apex oil cup filled with cotton waste to hold oil